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DEPARTMENT  
OF  
**CHEMISTRY**

HISTORY AND A MEMOIR  
1909 - 2003

**W. E. HARRIS**



Cover Photographs:

Upper Left	Arts Building, Chemistry Headquarters 1915 - 1923
Upper Right	Medical Building, Chemistry Headquarters 1923 - 1960
Lower Left	Chemistry West, completed in 1960
Lower Right	Chemistry East, completed in 1971



**DEPARTMENT  
OF  
CHEMISTRY**

**HISTORY AND A MEMOIR  
1909 - 2003**

**W. E. HARRIS**

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## PREFACE

Sixty-nine years ago (1934) I came to the University of Alberta as a student. I have known every President except the first one and every academic member of the Department except the first one and the most recent appointees. The University was then a small primarily teaching institution. My undergraduate chemistry instruction came from five of the six founders of the Department, the charismatic Sandin, the likable Stover, the statesman Walker, the enigmatic Boomer, and the kindly Shipley.

For almost six decades I have had a role in the University including opportunities, challenges, and rewards. I have met and have been privileged to work with many fine individuals. The following chronicle is written the way "I see it", including some aspects with rose colored glasses and some with jaundice. Some personal history necessarily permeates throughout.

My emphasis is on the academic side of the Department. Others could write about different and additional aspects of the Department. Many individuals who are not specifically identified made important contributions. The crucial help of secretaries, personnel in the storerooms, service units, technicians, graduate students have played roles in the development of the Department.

Some small items often of a more personal nature are included among the footnotes or are set in smaller type. The major memoir material is in Appendix I with three sections that focus on my chemistry history. The graduate studies section describes a different world from the current one. Another section describes a year of rejuvenation, and the third, the transition from mainly teaching to teaching and research.

I wish to express my appreciation to the many who have contributed to this account. Drs. Graham and Kratochvil suggested that I should undertake the project. They have reviewed drafts and given me

incisive comments. Dr. R. Crawford has provided continuing advice and assistance. He suggested the development of an Appendix II which lists all of the graduate students who obtained PhDs from the Department. Special thanks to him for searching for and compiling the list of almost 700 names. I deeply appreciate the willingness of Drs. Crawford, Jordan, Kratochvil, Horlick, and Cowie to summarize some of the main aspects of the Department during their terms as Chairmen. Their additions bring the history up to date in a way that I cannot. I thank M. Harris, Dr. G. Harris, and Dr. W. Harris for their suggestions and assistance. My thanks for information and assistance obtained from Dr. S. Davis, Dr. M. Cowie, L. Ferguson, and J. Jorgensen. I appreciate the work of Hashem Taha who formatted the text, incorporated changes, and designed the cover.

The great depression and two world wars took their toll of the University in the early years. It took time for the University and the Department to grow and mature. There have been problems along the way but it is well not to be overly concerned with them. Many things were done right and the payoff has been fabulous. The Chemistry Department is not the same as it was even a couple of decades ago.

Information relating to publications and related topics are up to date to January 2002. In the material that follows I attempted to be accurate to the best of my knowledge. I regret errors and omissions that remain and accept responsibility for them. I welcome comments, suggestions, corrections, and criticisms.

## TIMELINE

1908 - University founded  
 1909 - A. Lehman appointed  
 1918 - R. B. Sandin  
 1919 - N. Stover  
 1923 - O. J. Walker  
 1926 - E. H. Boomer  
 1930 - J. W. Shipley  
 1940 - 56 J. S. Morrison, S.G. Davis, W.E. Harris, R.K. Brown,  
 W.J. Wallace, R.J. Crawford

1956 - 7 Transition year  
1957 - H. E. Gunning appointed  
1960 - First PhD graduated  
1967 - 74 - Gunning's leadership  
1974 - Continuing development  
1974 - W. E. Harris, Chairman  
1979 - R. J. Crawford, Chairman  
1984 - R. Jordan, Chairman  
1989 - B. Kratochvíl, Chairman  
1996 - G. Horlick, Chairman  
2001 - M. Cowie, Chairman

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# 1 INTRODUCTION

## 1.1 FOUNDING OF THE UNIVERSITY

Two sources<sup>1,2</sup> have served to provide much of the information about the earliest history of the University and of the Chemistry Department. Early in the 1900's there was a struggle between Edmonton and Calgary concerning the site for the University of Alberta. As a compromise Premier A.C. Rutherford chose neither and settled on the City of Strathcona. After announcement of the site, Bob Edwards, Editor of the Calgary Eye Opener wrote (I presume sarcastically) that he "*may be of some use in dispelling any ill feeling that may arise soon here.*" Without getting help from the Federal Government Premier Rutherford arranged the purchase of 256 acres from the City of Strathcona as a site for the new university.

Dr. H. M. Tory, one of the leading men in higher education at the time, was appointed as President with a salary of \$5000. The first meeting of the Senate was held in 1908 at the IOOF hall in Strathcona. Salaries of assistant professors were to start at \$1880 and rise to a maximum of \$2250. The top salary for a full professor was to be \$3000.

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<sup>1</sup>Departmental Publications Archives. 1909 - 1980. Mary Waters.

<sup>2</sup> *A History of the University of Alberta, 1908 - 1969*, W. H. Johns, University of Alberta Press, 1981, Edmonton Alberta,

For their first meeting Senate members received \$4 and lunch provided by Mrs. Rutherford.

Dr W. H. Alexander<sup>3</sup> was the first University staff appointment (Classics) and Dr E. Broadus (English) was the second. The University of Alberta opened its doors to 45 students on September 23, 1908 using the top floor of what is now known as the Queen Alexandra School (106 St. and 77 Ave.) Later the budget of 1909-10 was approved at \$30,000 with provisions for hiring professors of science, philosophy, and mathematics.

On June 10, 1909 appointments were approved for Dr. W.A.R. Kerr in modern languages, Dr. J. A MacEachran in philosophy, and Dr A. Lehman in chemistry. The year 1909 included the turning of the first sod to begin construction of the Arts Building. By 1910 there were departments of English, Classics, Modern Languages, History, Philosophy, Mathematics, Physics, Chemistry, Civil and Municipal Engineering. In 1911 Athabasca Hall became the headquarters for all the University faculties. On the first floor Room 141 to 145 was the Chemistry classroom and 149 to 156 the Chemistry laboratory<sup>4</sup>. Room 32 was the Chemistry storeroom and 33 to 44 the Chemistry preparation lab. Dr. A. Lehman lived in campus house #4.

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<sup>3</sup>Alexander's son Larry was a friend of mine and we attended the university at the same time. Larry was the Editor of the student newspaper, the Gateway. He later set up a company called Western Industrial Laboratory in Edmonton. Larry died in 2001. His son Lawrence is now general manager of the company.

<sup>4</sup> *My 45 Years on the Campus*, Reg Lister, p. 11. University of Alberta, Printing Department. Undated, about 1950.

## 1.2 CHEMISTRY - THE FIRST DECADE

Dr. Adolf Lehman was born and raised in Ontario and obtained his early chemistry education at the now University of Guelph. He obtained a PhD in Leipzig and then spent a decade in the civil service in India. He was the first chemistry appointee and was the Head of the Department from 1908 until he retired in 1930. Student enrollment was low and the class sizes were small. He taught organic, inorganic, and analytical chemistry in addition to other chemistry related topics. He published one paper (1 page). In 1918 it was the very first publication from the department and was entitled "The Tar Sands of Alberta" - especially interesting from the point of view of their current significance and ongoing development.



A. L. Lehman. Born in Ontario. PhD Leipzig. Appointed in 1908. Head of the Chemistry Department 1908 - 1930 (Department photograph).

The main teaching building was opened in 1915 - the Arts building. The second floor included the classrooms and laboratories for Chemistry from 1915 to 1923. The Arts Building was the main headquarters of the University for a long time, including, lecture rooms, laboratories, administration, library, and bookstore. By 1918 the University enrollment was 613 students.

The Arts building was the academic home to those who were part of early history, including W.H. Alexander (Classics), E. K. Broadus (English), W.A.R. Kerr and L.H.

Alexander (Modern Languages), J. A. MacEachran (Philosophy),

E.W. Sheldon (Mathematics), E. Sonet (French), J. A. Allan (Geology), R. K. Gordon (English), A. L. Burt (History), A. Lehman (Chemistry). A number of these individuals, according to legend, had strong personalities.

A. D. Cowper was appointed in 1912 to teach chemistry and was on staff for nine years. F. W. Seyer was appointed in 1918 and taught chemistry for three years. R.B. Sandin obtained a BA from the University of Alberta in 1916. He was appointed in 1918 to teach organic chemistry. During the following years he continued as a graduate student and carried out work in the summers that led to an MA and a PhD.

When he was appointed all of the small number of academic staff of the University were together in the Arts Building.



The Arts Building, Building #54 on the Campus Map (Photograph from Footnote 2 Page 210)



R.B. Sandin. Born in Minnesota, grew up in Alberta. BA from U. Alberta 1916. Appointed in 1918. MA 1919 U. Alberta. PhD 1924, U. Chicago. Retired 1964.

Sandin had been one of their students and continued to be a student as well as an academic colleague for almost all the years that the Chemistry Department was in the Arts Building. He retired in 1964. He and Lehman were the first two long-term staff members in chemistry,

For their first few decades both the University and the Department were largely involved in undergraduate teaching. At the graduate level only Master's degree studies were authorized.

Chemistry is composed of four major divisions, organic, inorganic, analytical and physical. A simplified classical definition of organic chemistry is that it involves compounds that include carbon. Similarly a definition of inorganic chemistry is that it involves the chemistry of all other elements that do not include organic carbon. Analytical chemistry deals with the identification, characterization, and measurement of chemical species present in a material. Physical chemistry is concerned with the study of the properties of material and tends to be the more mathematical and theoretical part of chemistry.

It is appropriate to divide the Chemistry Department history after the first decade into three major periods. During the first period undergraduate teaching was the main responsibility. I have arbitrarily chosen to name that early four-decade period after the longest term and most forceful individual of the time, Dr. R. Sandin. During his long tenure he had a profound influence on the development and status of the Department up to 1956. The second period was the beginning of major research activities in addition to teaching; it is named after the leader during the period 1957 - 74, Dr. H. Gunning. He had a profound

influence on the development and status of the Department up to 1974. He brought about the transition to a modern leading intellectual chemistry center. The third period is named the one of Continuing Development to the present.



## 2 SANDIN ERA

### 2.1 DEPARTMENT FOUNDERS

The founders of the Department of Chemistry are the following six: Dr. Adolf Lehman, Dr. Reuben Sandin, Dr. Norman Stover, Dr. Osman J. Walker, Dr. Edward H. Boomer, Dr. John H. Shipley. Other individuals were appointed to the department but for relatively short periods. I did not know Lehman<sup>2</sup> but I took instruction from the other five founders of the Department. The founders had diverse personalities.

Dr. R. B. Sandin was the second long-term member (1918 - 1964) of the Department. He taught organic chemistry and carried out research in the field. He published his first paper from the department in collaboration with Dr. Collip of Biochemistry in 1928. In the period up to the start of WW II, he published 25 papers (average length 3 pages) in the general area of organic synthesis of compounds of potential value in cancer chemotherapy. His popularity as a lecturer was legendary throughout the Department, the University, and beyond. He cultivated close personal relationships and had a major impact on many students. For generations of students, he was an idol and the object of hero worship. He took pride in

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<sup>2</sup> In the following material, I adopt a somewhat informal style and do not always use full academic titles. On the other hand, I do not carry the informality to a level of my discomfort.

lecturing without notes. On some occasions, he would go through an act of fumbling his pockets for a scrap of paper for a piece of data. He was a charismatic showman and entertainer.

Sandin's grading standards were widely recognized for what would now be called grade inflation. During their first lecture of introductory organic chemistry, he told one group of nursing registrants that he would give them all a passing grade in the course. In general, students knew that in his courses they could expect an extra 20% or more above their usual course marks and would have their average raised for the year. For many, high grades served as confidence builders that probably served them well in later years. Sandin resisted attempts at grade control from the administration.<sup>4</sup>

Sandin was complex, had strong convictions, and tended to see things in white or black. He cultivated an image of a humble jus'-folks person and a champion of the weak. He spoke about Lehman in glowing terms. He told us about favorite students such as D. W. Woolley, R. M. Eloffson, M. Kulka - who became competent, productive chemists. In the mid 30's, we students often heard rumors

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<sup>4</sup> Anecdotal - I had 2.5 years of instruction in organic chemistry from Sandin, including one year of introductory organic, one year of advanced organic and a half year of qualitative organic analysis. I was assigned grades in the high 90s - my three highest grades ever I aced them. In graduate school at the University of Minnesota, I wrote the non-major non-minor organic examination based on a one year introductory course. I failed. My earlier spectacular grades seemed not to reflect an adequate knowledge of organic chemistry at the introductory level.

that Sandin was leaving Alberta for another university. We worried and hoped the rumors were wrong.

It was not a good thing to get on his wrong side. When I was in the introductory organic chemistry course, I realized that a dumpy looking student by the name of Archibald<sup>†</sup> must have done something to annoy Sandin. A couple of others who found themselves on the wrong side were E. Spencer and D. McWilliams - they were deemed bad boys because they took leading roles in student clubs. They also became competent, productive chemists. There was mutual antipathy between Dr. Sandin and Dr. Hunter, Head of the Biochemistry Department. More generally, he scorned administrators as villains. He told us about his cottage off the beaten track in Waterton Lakes where he could go for a vacation and not run into anyone associated with the University.

Sandin inspired many honors chemistry men to undertake graduate studies in organic chemistry. He gave them strong encouragement and assistance. He had good connections, particularly with the Universities of Wisconsin and Illinois. Consequently, many of the Alberta Honors Chemistry graduates obtained advanced degrees from those or other U.S. universities. The one of highest renown who chose to carry on in organic chemistry was Dr. R. Lemieux.

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<sup>†</sup> A.C. Archibald was killed in WW II. *The University of Alberta in the War of 1939 - 45*. L. G. Thomas, Page 60.

Dr. N. Stover was an inorganic chemist, appointed in 1919 and died in 1938. He obtained a BSc at the University of Alberta and did his graduate work at the University of Illinois at a time when the Hopkins group there incorrectly thought they had found the lanthanide element number 43 and proposed to name it illinium. Element 43 is unstable and has since officially been named technetium. I found him to be an excellent teacher and it was easy to like him as an individual. The good reputation of his course equivalent to high school chemistry was well known outside the university. He had three career publications. No photograph could be located.

Dr. O. J. Walker was an analytical chemist appointed in 1923 and retired in 1957. He was from Saskatchewan and obtained an MSc from Harvard and a PhD from McGill. He was at Harvard at the time of T.W. Richards and his atomic weight work that led to the Nobel award in analytical chemistry. In his early years, he had a reputation as a good instructor but in later years his teaching reputation was less favorable as his administrative load became excessive. Recently, a chemical engineering graduate of 1950 told me that he viewed Walker as a statesman. Walker became the third Head of the Department in 1941 when he succeeded Shipley, who became ill.



O. J. Walker. Head of the Department 1941 to 1957 (Department photograph)

During the period up to the start of WW II, Walker published seven papers (average length 7 pages). He studied the effects of trace elements on health, for example the relation of iodine to goiter, and of fluoride to dental caries. He carried out a province-wide survey of the incidence of goiter in relation to the level of iodine in the water supply. *"It has been found that there is a reasonable correlation between the lack of iodine in the water and goiter"* Walker also strongly promoted the fluoridation of water supplies as a public health matter.

Walker paid unusual attention to the laboratory part of instruction and in this respect he no doubt had been influenced by the magnificent work of TW Richards. When he visited the laboratory, he would quiz students about the chemistry involved. That kind of attention frightened some. A few clever students solved the problem by having a question ready to ask him when he came around. He probably loved it. He graded by rigorous but fair standards. My grades in analytical chemistry were far from my best but his field attracted me most\*. Walker took his share and more of administrative duties outside the Department. For a few years, in addition to the duties of Head of the Department, he carried out the duties of what is now called Dean of Graduate Studies. He contributed to the welfare of chemists at the national level and took an active role in the Chemical Institute of Canada. He and his wife Ella played an active role in the Alpine Club of Canada

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\*In my second year at the University the course in chemical analysis and the careful work that was involved attracted my interests.

Dr E. H. Boomer was from UBC and McGill. He was a physical chemist appointed in 1926 and died in 1945. He was the most productive researcher in the Department and up to the start of WW II he had published 21 papers (average length 10 pages), often involving phase equilibria of hydrocarbons. From a student point of view, he was the least competent teacher in the Department. His lectures were simply impossible to follow and understand.



External to the university, he discharged an important public service when he assisted in the formation of the Province of Alberta Oil and Gas Conservation Board and was its first chairman. During WW II, he made distinguished contributions as a tireless worker in his role as the technical advisor to the Western Advisor to the Allied War Supplies Corporation. He had a role in the construction and operation of the ammonia plants at Trail B.C. and Calgary. He was a consultant for the research program on atomic energy. In October 1945, he died shortly after his return from a technical survey for the Canadian Government of German industrial plants manufacturing synthetic liquid fuels. As students, we were largely unaware of his public service activities and that he was the premier scientist in the Department.

E. H. Boomer staff member 1926 - 1945 (From page 305 of Footnote 2)

Chemistry students with an interest in graduate work in physical chemistry often took an MSc under his direction. For further graduate studies, his students often went to McGill University.

Dr. J. W. Shipley was from Manitoba and obtained a PhD from Harvard. He was a physical chemist and was appointed in 1930 to succeed Lehman as head on his retirement. Shipley died in 1942. He was a kindly person who gave quiet encouragement. He published eight papers (average length 9 pages). He was dedicated to the enhancement of the welfare of the department and the University. He appeared to carry out the duties of Department Head with responsibility. One of his major publications dealt with chemistry as a profession. In it he wrote about organization, research, chemistry in relation to industry, resources, and academic matters.



J. W. Shipley - head of the Department 1930 to 1942 (Department photograph)

## 2.2 LIFE IN THE CHEMISTRY DEPARTMENT

Shortly after WWI, University enrollment was just over 1000 students. The total enrollment in 1923 was 1341 students. By 1940, enrollment in the University reached 2000 students. The five founders, Sandin, Stover, Walker, Boomer, and Shipley, were in the department throughout the great depression and at a time when the University had

strained finances and when University salaries were actually reduced. There was almost no support for research from University sources and there were but few MSc students.

In 1923, the Medical Building (now called Dentistry Pharmacy) was completed and became the headquarters for Chemistry on the west end, basement, first, and second floors. After the end of WW II, the west wing extension gave the Chemistry department more space at the west end of the building.



The Medical Building, spring 1939 looking northwest. Power plant north of the Medical Building. West and east wings added in 1948. Just west of the building, saskatoons could be picked in midsummer Building #72 on the Campus Map (Photograph by WEH)

Doctoral level graduate work was authorized for the University of Alberta about 1950. The two major PhD degree-granting institutions in Canada at that time were McGill University and the University of Toronto

When I was a student<sup>9</sup> in Honors Chemistry in the mid 1930's I took courses from each of the five founding professors. I would rank their teaching competence in the order Sandin (far ahead), Stover, Walker, Shipley, and

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<sup>9</sup> When I was a child I had little access to books. At home there was a set of Book of Knowledge from about 1890. I read and reread them. Articles that included chemistry aroused my interest in the subject. The brief chemistry instruction I had in Grade 12 was especially interesting and confirmed my wish to study chemistry



**Boomer.** Honors Chemistry students who were in their third and fourth years were given jobs as demonstrators for chemistry laboratory sections for 3 hours per week. My first paying academic activity was interesting and for the service a welcome \$10 per month was received. For services rendered the pay was about right.

### University Life

Before coming to the University I had heard that hazing was to be expected for freshman students. Hazing was a rite of initiation carried out by senior students involving humiliation, sadism, and bullying of freshmen - supposed to be great fun. In 1934, a student by the name of Powlett was driven to a nervous breakdown by the hazing. His father sued the University. The University lost and the cost was about \$100,000 - a sum at that time equal to the total salaries of dozens of professors. Beginning in 1934, hazing activities were prohibited.

The University was more formal than it is now. Professors addressed us not by our first names but by our surnames. I felt more like an adult when Dr. A. Cook in the mathematics class addressed me by my last name, for example. There seemed to be an attitude of respect from and to the staff as well as from and to the other students. Prof. L. H. Nichols of the Physics Department wore an academic gown to his lectures and there were other staff that did so but none of my other instructors. Students were also more formal. Others and I wore a suit with tie to lectures. Brad Gurn, my longtime friend, had shirts with detachable collars - a little more formal.

Students did not use the first names of professors and most often we never even knew what they were. Today the change has been profound. I recently read an MSc thesis in which the student acknowledges his supervisor Dr. X. Then in succeeding sentences he thanks George for this and George for that. It just does not seem to be an adequate level of respect. Such informality was impossible to imagine a few decades ago.

Freshman students were expected to attend the monthly lectures given by President R.C. Wallace. They were inspiring talks and I looked forward to them. At meetings of the Science Association, staff members presented talks on their research. I especially remember an excellent one from Dr. W. Rowan of the Zoology Department concerning the behavior of birds in London. Discussion and comments followed the talks and my impression was of scholarly role models. I also attended some presentations of the Philosophical Society and saw the apparently civil collegial atmosphere of mutual respect.

In the second term of my first year I moved into Athabasca Hall residence. For supper there was some formality. For example, I was assigned to a table of 12 where one of the more senior students acted as server. Grace was said by one of the professors in residence.

Almost all our instruction was taken in either the Arts Building or the Medical Building. Both of these buildings have imposing front entrances with wide staircases. Between classes we often had to go from one to the other. The most direct route was to or from the back door of the Arts building to or from the back door of the Medical building. The back entrances had single doors and the traffic flow was certainly impeded even with only 2000 students. The architects were not too practical in their designs.

After graduation most Honors Chemistry and Masters students left to attend graduate schools to obtain advanced degrees. Sandin instructed honors chemistry students: *"When you leave don't ever come back to this Department!"* No explanation, but we had the unpression that he found the University of Alberta a terrible place to work. I have now wondered whether in his years in the Arts building when he was both a continuing student and an academic colleague, whether the other staff had difficulty accepting him as a colleague. Did they impose on him their

values and did he have adequate humility in their view? Dr Davis told me at about that same time that Shipley had told him to never become a university professor. Sandin also advised us that when we planned to go to graduate school we should have enough money to last one year and everything will work out.

One of the requirements for MSc students and honors students in their 3rd and 4th years was to take part in the Journal Club. It met weekly on Wednesdays. Once a year each student was given the responsibility of presenting the findings of an assigned publication in the chemical literature.<sup>10</sup> The chemistry staff attended the Journal Club meetings. It was a time when we saw some of the interactions between staff members. At the beginning of most every meeting Sandin would initiate what, in hindsight, I realize was an affront to another staff member. Shipley as Head most often was the one that responded to the provocation. The combative atmosphere was uncomfortable and unpleasant. Student sympathies were on the side of the popular Sandin. In hindsight, there was probably a power struggle going on in which Shipley as

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<sup>10</sup> A couple of personal memories. First, in the absence of any expert instruction I naively thought it was important to make presentations without the aid of notes. Accordingly I prepared carefully and attempted to give my presentation. It was a disaster. It would be seven years before I received competent advice about presentations. Second, when I was an MSc student, I was given freedom to report on a journal article of my choice. I chose to report on an article by Harold Urey on his discovery of deuterium and heavy water, work which later led to his Nobel Award. I had lucked out at the time and I didn't really appreciate the extraordinary significance of the Urey work. At the conclusion of my presentation, Shipley complimented me on my choice of article.

Head was striving to retain the alpha position in the Department.

## 2.3 SIX NEW APPOINTMENTS

The last of the six founding members of the Department had been appointed in 1930. By the 1940's replacement staff were needed and enrollment had increased sharply. Hiring of new staff was necessary to maintain the strength of the Department.

**Dr. J. S. Morrison**, BSc University of Saskatchewan, PhD McGill Physical Chemistry. A dedicated communist, he was appointed in 1940. He left the department in 1958.

**Dr. S.G. Davis**, BSc Chemical Engineering, and then MSc Alberta, and PhD Physical Chemistry McGill. He received a letter from Boomer in 1942 inviting him to accept an 8-month temporary appointment. After a year he received a full-time appointment and retired in 1982.

Morrison and Davis were the two wartime appointments.

**Dr. W. E. Harris**, BSc, MSc University of Alberta, PhD University of Minnesota, analytical chemistry, appointed September 1, 1946 and retired in 1980.

**Dr. R. K. Brown**, BSc University of Alberta, MSc, PhD McGill organic chemistry, appointed in 1946, died of cancer in 1974.

**Dr. W. J. Wallace**, BSc. UBC, PhD Purdue inorganic chemistry, appointed in 1954, left the department in 1963.

**Dr. R. J. Crawford**, BSc University of Alberta, PhD University of Illinois, organic chemistry, appointed in 1956, retired in 1994.

## 2.4 CHEMISTRY FOLLOWING WORLD WAR II

The academic staff in 1946 consisted of four junior members, Morrison, Davis, Harris, and Brown, and 2 senior members, Walker and Sandin. During the late 40's and early 50's, with the possible exception of Morrison, we all had heavy undergraduate teaching loads. In the years immediately following WW II, a surge of veterans was going through the University. Enrollment went from 2023 in 1943-4 and 2679 in 1944-5 to 4811 in 1945-6 and 5927 in 1946-7.

In 1946, my first lecture was to a freshman class of 232 students in Lecture Theater Med 158. For a new staff member I have long felt I was uncommonly lucky to begin my teaching career with a high



Dr. R. Shaw of Bacteriology in Lecture Theater Med 158. Med 142 and 158 were heavily used for chemistry lectures. Blackboards could be raised and lowered. (1938 Photograph, WEHI)

proportion of war veterans in the class. Veterans wanted to make up for lost time and were ready to study. I was lucky also at an earlier time to have taken some instruction about

oral presentations from Prof. Ziebarth<sup>11</sup> and to him I owe a near lifetime debt of gratitude.

Walker was Head of the Department through most of WW II and until his retirement. At the end of the war he was pleased that he had been able to get authorization for the first new building project (west wing addition to the Med building) on the campus since prior to the depression. He was heavily involved with both teaching and administration. He took a full instructional load in freshman chemistry, analytical chemistry, and industrial chemistry. He was often called on to contribute to administrative duties outside the Department, and outside the University. His course in analytical chemistry became increasingly out of date. In his last years his excessively heavy workload and responsibilities were obviously a cause of stress.

In 1946, there were six lecture sections of freshman chemistry - 1100 students taught by Walker, Davis, Harris, Brown, and two sessionals, Dorothy Coggles and Sybil Fratkin. With no teaching assistants to help, grading of examinations and assignments was a major commitment.

Space was inadequate and the facilities had to be used to their limits. Accommodations were provided by the erection of temporary buildings. I shared an office with Morrison while the expansion of the west wing of the Medical Building was under construction. Classes ran from

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<sup>11</sup> Prof E.W. Ziebarth was a night school instructor at the University of Minnesota. See Ziebarth near the end of Appendix I, A.

8 in the morning until 10 at night. Classrooms and laboratories were stretched to the limit due to the increased number of students. Davis and I oversaw the freshman labs that ran from 8 - 11, 12 - 3, 3 - 6, and 7 - 10. Classes were held on Saturday mornings, a custom that continued into the 60's. Dorothy Coggles looked after the detailed laboratory instruction.

### Sidelight

The Medical Building was the headquarters for several science departments. It included Entomology with Dr Brian Hocking. He carried out research involving the physiology of houseflies. Many of his "animals" escaped custody. The result was that we had the nuisance of flies the year around in the building. Another unfortunate circumstance involved the Zoology Department. That Department was mainly on the second floor but they had one small room on the first floor adjacent to the Chemistry area and well away from the Zoology offices. Zoology used that room to store biological material such as rotting moose heads. The smell was dreadful. Since it seemed to be part of Chemistry, Chemistry got the credit for the rotten smells. "That chemistry simply stinks!" was to be heard again and again. There were some chemical smells but they were nice and clean compared to the biological material. It was a relief when we obtained quarters separate from zoology.

Chemistry occupied the west part of the basement, first, and second floors of the then Medical building. Biochemistry was directly above us on the third floor. The fume hoods were inefficient and the freshman labs had foul air. One of my colleagues in Biochemistry complained that fumes from our fume hoods were leaking into their rooms. We decided that as a test I would add some strong smelling material into one of our hoods and he would assess the situation on the third floor. Accordingly, I added several milliliters of butyl mercaptan to one of our hoods. I don't remember our conclusions. I do remember that a few days later, the Gateway had a headline about the evacuation of Rutherford library because of a mysterious gas leak. The explanation is

probably that there must have been a gentle west wind that carried some of the mercaptan (used as an odorant for gas) from the exhaust air of the Medical building east for about 0.3 km to the air intake for the Rutherford library. In the library, they of course found no gas leak but there was a period of consternation.

It was a time when some non-chemistry aspects of the university could be sampled. I and other junior staff members attended (and observed) the council meetings of the Faculty of Arts and Science. It was a single faculty until 1962 when it was split into the Faculty of Arts and the Faculty of Science. John Macdonald, a professor of philosophy, was the Dean of Arts and Science until he retired. He had admirable ability to control the meetings and the sometimes intense but civil arguments that took place. I have remembered a remark that one of my contemporaries made to the effect that with contentious matters in a university the stakes are remarkably low - tempests in a teapot.

At this time, Sandin was at the top of his game. He inspired esteem and loyalty. He had most of the MSc students in the Department and continued to be even more deeply admired for his teaching.<sup>12</sup> His last lecture of the year had become famous. Visitor students from around the campus including Arts students would crowd into the

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<sup>12</sup> R. Melby was an MSc student and protégé of Sandin. He copied Sandin. He presented a paper to the Journal Club in the manner of a near perfect clone - no notes, same gestures, same facial grimaces, and the same business of searching pockets for a scrap of paper for a bit of data.



lecture theater to hear his entertaining last lecture of the year "The Moon is Made of Green Cheese."

The Journal Club continued as one of the requirements for Honors Chemistry students. Only Walker and Sandin remained of the founding members since Stover, Shupley, and Boomer had died. Walker avoided arguments, so the atmosphere of the Journal Club was less confrontational. However, once in a while at the Journal Club, Sandin would disparage the admittedly modest research projects of the other chemistry professors, each of us in turn. The lack of respect for colleagues was an uncalled for and uncongenial aspect of the Department<sup>13</sup> at that time.

#### **Aspects of My Early Career as a Professor**

During my first years in addition to my several courses I worked closely with Walker. We shared freshmen chemistry teaching with others. He asked me to instruct the laboratory for his course in analytical chemistry. There were no T.A.s, and only a couple of student demonstrators to give some assistance. As a new instructor, I found Walker to be an always helpful colleague, and to give good advice when asked. I showed him a draft of my first exam in freshman chemistry and asked for suggestions. He kindly suggested it might be a little too

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<sup>13</sup> I think Sandin at that time had difficulty accepting young chemistry professors as colleagues. He seemed to feel a need to impose on us his vision of the straight and narrow and there were irregular little unpleasant sessions initiated by Sandin involving petty personal affairs - I remember one for our perceived inadequate humility. I was the first honors chemistry student to return as a staff member. Early on Sandin aggressively chastised me because I had returned as a staff member in disobedience of his instructions to honors chemistry students. On the other hand Walker had come to Minneapolis to persuade me to return as a staff member.

difficult. I later realized that the draft exam would have been suitable for a graduate student and not for freshman students.

In my first year the laboratory instructional duties in the analytical course alone took about 30 hours per week. Walker went along with the changes that I began to make in the running of the laboratory after the first year. For example, I wanted the students to be told more than a simple "acceptable" or "not acceptable". I began to assign grades for analyses on a 5-point scale. I had rewarding collegial interactions with Walker, with the other junior members of the Department, and with students.

## 2.5 SUMMARY OF THE ERA

During this period, teaching was the main responsibility of the academic staff. During the first couple of decades student enrollment was low, and the staff few in number. They published results of research at a moderate rate. After World War II enrollments increased strongly, facilities were overcrowded, and teaching responsibilities were excessive.

During this period, Sandin was the powerful and popular superstar and not much could go on without his tacit agreement. He dominated in teaching and enjoyed an excellent teaching reputation. The support for research in the University was low however, and even within the University the Department of Chemistry was at the low end of the scale. If the Department were to move forward the weaknesses would need to be addressed.

## 2.6 1956-7 A YEAR OF TRANSITION

The fall of 1956 was a critical time for the department. The academic staff consisted of Morrison, Davis, Harris, Brown, Wallace, and Crawford along with the two long-term members Walker and Sandin. Walker, the Head, was to retire in 1957 and a new Head would have to be chosen. The appointment of a strong, able, forward looking leader was imperative. Walker was President of the Chemical Institute of Canada for the 1956/7 year and in that capacity he had to be away from the Department a good deal. In the spring of 1956, Sandin obtained a sabbatical leave for 1956/7. Therefore, 1956/7 was the transition year between the Sandin and Gunning eras.

The six junior members of the department recognized that no one of the continuing members of the Department would be suitable to succeed Walker as Head. We were aware that the future of the Department was now in our hands to shape. The ball was now in our court. We wanted to be part of a better University and a better Department. We needed a new Head with the ability to carry us forward. Permission was obtained to appoint a new Head from outside the University. Crawford told me that the welcome permission had been the result of some behind the scenes actions by Sandin with Dr. W. Johns, the V.P. Academic. In consultation with Dr. Johns, we obtained permission to interview three prospective candidates. By 1956, we had authorization for a new Chemistry building and preliminary plans were under way with significant input from Davis and

Crawford. That new building is now the west wing of Chemistry.<sup>14</sup>

### V-wing Theaters.

The V-wing Theaters had an interesting origin. Morrison had always taught classes with low enrollment - either the advanced physical chemistry or the makeup pre-university chemistry for a few students. In 1955 for the first time he was assigned to teach a large class with a couple of hundred freshman students. That was a traumatic experience for him. Consequently, in connection with the design of our new building he argued for a series of lecture theaters that would each hold only a hundred or so students and would be joined to the chemistry and physics buildings. With small lecture rooms for freshman chemistry, he reasoned that the university would have to appoint more chemistry staff. Today the fourteen excellent V-wing Theaters continue to serve the University well. I have not seen a better or more efficient arrangement of classrooms in any other university. About one quarter of all classes in the University continue to be of a size suitable for such accommodation. Interestingly, they were never suitable



The 1960 just completed V-Wing Theaters - Dr. Morrison's legacy. (WEN photograph)

<sup>14</sup> On a personal note I had now been on staff for a decade and wished to have a study leave for the year 1957/8. Walker gave permission for me to make arrangements for such a leave.

for the two or three thousand freshman chemistry students that Morrison had in mind and that later materialized.

### 3 GUNNING ERA

#### 3.1 APPOINTMENT OF A LEADER

The Committee for the appointment of the new Head of Chemistry consisted of Mr. A. Stewart, President of the University, Dr. W. H. Johns, Vice President, Dr. A McCalla, Dean of Agriculture, and Dr. J. Morrison and Dr. W. Harris from Chemistry. The chemistry six (Brown, Crawford, Davis, Harris, Morrison, and Wallace) obtained suggestions for candidates from several sources. Dr. Steacie of NRC was especially helpful in that respect. We ended with six names and were permitted to invite three to come for interviews in the spring of 1957. They were Dr George Janz from Rensselaer, Dr. Bob McIntosh from NRC and Dr. Harry Gunning from Illinois Institute of Technology. At that time, there was no Faculty Club and therefore hosting, special meals and entertainment was arranged in our homes. In particular, three of our wives, Norene Brown, Nona Davis (dec.) and Phyllis Harris (dec.), are owed special acknowledgment and thanks. We arranged for the candidates to interview key University administrators and we had time with them individually and as a group. We gave assurances of our unity of purpose that we wanted a leader to take us forward. As a selling point, we indicated that we had authorization for a new Chemistry building.

During the time of the on-site interviews, we had tight schedules. One evening in particular, we were

scrambling. Dr. McIntosh had just completed our interviews and was at the home of the Browns for supper along with some of the chemistry people. I had the duty of meeting the plane at the municipal airport to pick up Harry and Donna Gunning and their daughter Judy. They came from Chicago as I recall in a DC-3 by way of Minneapolis. They had supper at our house along with some other chemistry people. Harry was a friend of McIntosh and somehow knew he was still in Edmonton. He wanted to have a talk with McIntosh. I thought that was inappropriate and did not accede to his request.

During the time the appointment committee was active, Brown and Crawford kept unrelenting pressure on me to accomplish our goal of getting an able new Head who would take the actions needed that would lead to a better department. Walker did not meddle and Sandin was on sabbatical. In the appointment committee, Dr. McCalla was a helpful supporter of our objectives. The President, A. Stewart, in my opinion was the least forward-looking president this university has ever had.<sup>15</sup> For example, at a meeting of the Staff Association, President Stewart said that the maximum future enrollment of the University would be 5000 students and no plans should be made inconsistent with that absolute maximum. He further stated, privately, that it would remain an undergraduate University with the now University of Calgary remaining as a Junior College.

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<sup>15</sup> I have known all of them except the first, Tory, and have worked with six.

In the Department, we clearly favored Dr. H. Gunning as our first choice. McCalla made it clear to me that he also favored Gunning. Gunning was a University of Toronto undergraduate where he obtained a combined honors degree in English and Chemistry. In 1942, he obtained a PhD in Physical Chemistry with Dr. A. Gordon from the University of Toronto.

After the interviews and at the crucial meeting of the appointment committee, A. Stewart wished to dismiss Gunning as a serious candidate. He stated that Gunning was just playing games with us. I had learned that Gunning would be at the spring meeting of the American Chemical Society in Miami in a couple of weeks. I told the committee so and said "Send me there and let me talk to him." The President and VP consented to the expense and I went to the ACS meeting. There, I talked with Gunning. In my report<sup>18</sup> to the committee, I informed them that Gunning was indeed willing to come and was awaiting a definite adequate offer from the University. He asked that he be given assurance in writing that the conditions and facilities for an active research department would be supported. Our initial salary offer of \$10,400 was not adequate. The President and VP



H.E. Gunning, Chairman,  
1957 - 1974 (Department  
photograph)

<sup>18</sup> The handwritten report of my "Talk with H. Gunning in Miami by W. Harris" has been sent to University of Alberta Archives along with letters and reports. "Appointment of a Head for Chemistry, 1957"



proceeded to complete the negotiations and Gunning would be the new Head on August 1st 1957

My next business was to make personal and family arrangements for a year leave of absence<sup>17</sup> at the Chalk River Laboratories (Appendix I, B). That year was an enormously rewarding one from both the family and professional points of view. On our return from the year away, my optimism for the future of the University of Alberta Chemistry Department was at a high level.

### 3.2 GUNNING LEADERSHIP 1957 - 1974

Gunning moved to Edmonton in August 1957. With single-minded attention to unnumerable details, he began to systematically develop and maintain conditions favorable for carrying out research. In a really short time, there was a tremendous feeling of vitality in the department. Chemistry soon became a role model for and gave a boost to other departments. The shock waves he created resonated throughout the University. He infused us with a feeling of strength. From the beginning, Gunning said again and again that our most important duty was research. The decade following 1957 was one of solid growth and progress at a level that we hoped for but few of us could have foreseen or dreamed of in 1956.

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<sup>17</sup> Dr. Walker appointed Dr W Allen to the Edmonton campus from Calgary to take over my teaching duties for the year 1957/8.

### Timing

The timing of the appointment of a new Head simply could not have been more fortunate. Gunning inherited a small united group that actively supported forward-looking leadership. He had no problem staff to try to handle. He was able to make many new appointments of his choice. Not surprisingly, his new appointees were treated more generously than the continuing staff.

Another important aspect of timing was that barely more than a month after his arrival, the Russians launched Sputnik I on October 4, 1957. The world was astonished and was soon galvanized in favor of support of basic sciences. Sputnik was really mostly an engineering triumph but that was not the way the public and politicians viewed it. With a major inadvertent assist from Russia, Gunning was able to shake the money tree to obtain support for his vision of the future department. He maintained excellent services and financial support for research and teaching.

### Recruitment

As a condition of his appointment, Gunning had won a part of the financial support battle with his then out-of-line salary. He also obtained permission to bring in several graduate students as teaching assistants at unheard of high stipends. In the matter of graduate student stipends, we led the world, and at a time when the department was little known internationally. High quality graduate students from many countries were attracted. He actively recruited new staff. He made 8 new academic staff appointments by 1959 and 19 by 1964. Overall, during his 17-year tenure, he made

45 academic  
appointments

(Listed in  
Section 3.3)

Active  
recruitment of  
graduate



Teaching assistant giving laboratory instruction (From Chemistry Bulletin 1963, Page 14)

students by way  
of high stipends  
continued. He

wrote personal letters to some of the highest achievers in freshman chemistry with invitations to enroll in honors chemistry Teaching loads were slashed to a small fraction of those of earlier times. Teaching assistants provided important help with respect to undergraduate teaching responsibilities.

### PhD Program

Authorization for a PhD program in Chemistry had been promised in 1957 and was obtained almost immediately. As research began to be a larger part of the University, the status of the School of Graduate Studies was raised to that of a Faculty and McCalla was made its Dean. In 1956, a University regulation forbade admission of its own graduates to its PhD programs Gunning challenged that regulation. He argued that the regulation had the effect of providing scientists for the United States, (Footnote 2, P. 268) *"since 80% of the students who go there for doctoral work stay there after graduation As a result Canada loses the services of a substantial number of scientists who are vitally needed in this*

country.” The Faculty of Graduate Studies was persuaded and did change the regulation. Gunning also argued that the public should pay for excellence and quality in academic affairs and should give the University the level of support that it deserves. The Premier of the province, Earnest Manning, gave financial support for rapid campus expansion and supported the role of the University in society.

During the first couple of years of the Gunning era, the Department remained crammed into the west end of the Medical building. A hardly used women's washroom in the basement was converted to a research lab and office for Dr. G. Freeman. The new Chemistry building was under construction at this time along with the Physics and Mathematics building and the adjoining V-wing. Gunning was heavily involved with the detailed building plans for the new chemistry headquarters. The building was completed in 1960 and we moved from the Medical Building to the present west wing of what is now called the Gunning-Lemieux Chemistry Center. With the new building, we had far more office and laboratory space.



Chemistry west wing completed in 1960. Building #30 on the Campus Map (Photograph WEH)

### Teaching

In comparison to research, Gunning paid little attention to and seemed to downgrade the importance of undergraduate teaching. For a few years, enrollments actually dropped in undergraduate chemistry courses. The staff covered the teaching obligations, but the situation was anarchic. Undoubtedly, partly through a sense of obligation to students, Dr F. Birss organized the teaching of freshman chemistry for a number of years and that was a considerable commitment from him.

Earlier when there were eight academic staff and no teaching assistants, the teaching loads were three or four times greater than now when the department had 30 or so staff and many teaching assistants.

### Research

Most of the new appointments Gunning made were in organic and physical chemistry. At one time, there were 16 physical chemists on staff and within physical chemistry special attention was paid to the theoretical side with five appointments. A special boost to the research side of the Department resulted when Dr. R. Lemieux from the University of Ottawa joined the staff in 1961.

The conditions for carrying out research were superb for all academic staff. However, some staff were given more assistance than others through light teaching loads or Department supported technical or other assistance. Thus, a two-tier system was developed. Examples of those with extra assistance include: Fraga, Ayer, Freeman, Strausz,

Masamune, and Lemieux. Gunning built his own research group into an empire with many supporting technical and other staff. Dr. W. Graham as a new arrival in 1962 said his impression was *"As I looked into various research laboratories in the large building, I formed an impression of acres of glass high vacuum systems with gas storage bulbs up almost to the ceiling. Gas-phase photochemistry and kinetics were the focus of Gunning's research."* For a few years, Dr. W. Allen took care of many administrative aspects of Gunning's group. Later, Dr. O. P. Strausz had a special relation with the Gunning group.

### Services

One of the really important developments was to obtain the financial resources necessary to establish Technical Services units that served the needs of all academic staff: machine shop, electronics, drafting, secretarial services, glassblowing, and chemical stores. At one time, there were two glassblowing shops with about a half dozen glassblowers. Among other duties they made Dewar flasks in all sizes to meet the department's needs.

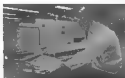
One of Lemieux's special contributions was to organize spectroscopic services, such as Nuclear Magnetic Resonance and Mass Spectroscopy



Hubert Hofmann, machine shop Supervisor. Recent winner of the Outstanding Technician Award (Folio, University of Alberta, April 4, 2003, Page 6.)

facilities as true services for all in the Department. Gunning obtained the financial resources needed for this important development. The alternative in other major Canadian departments was that vital and expensive instruments were owned by research fiefdoms of individual staff members. Under such management, service to other researchers had reduced or no priority. The availability to the whole Department of superb state-of-the-art spectroscopic and other facilities gave staff members a considerable edge, and helped to make possible the rapid rise of the Department to one with a national and international reputation.

Gunning recognized the desirability of offering attractive career positions to key people, and created within the University's ranks the position of "Administrative and Professional Officer" (APO).



Faculty Service Officer, Dr. A. Hogg  
(From *Chemistry Bulletin* 1982, Page 9).

Don Mackenzie as an APO was hired as purchasing agent and personnel manager. Another farsighted move was the creation of similar non academic positions for skilled and experienced managers of departmental services. They were Faculty Service Officers (FSO). For example, Dr. A. Hogg was appointed as an FSO in charge of mass spectroscopy services.

When a mistake became evident, Gunning took corrective action. For example, having a general pool of secretarial assistants did not work out well. The secretaries

were therefore relocated to individual offices and each was assigned to a group of academic staff. Dissatisfaction with the way academic staff appointments were being made in organic chemistry led Lemieux to persuade Gunning to recognize the four divisions in chemistry - Analytical, Inorganic, Organic, and Physical - and to appoint a divisional chairman for each. In another context, Lemieux also gave a boost to the experimentalists when he argued that undergraduate laboratory instruction should be included when assessing teaching loads. Lemieux also rationalized the chemical storeroom hours.

In the 1960's, Gunning promoted the design and construction of the east wing of the Chemistry Building at a time when probably no others in the Department saw the need for it. It was a farsighted move on his part that now stands us well. The combined west and east wings were renamed the Gunning-Lemieux Chemistry Center in 2001. The renaming was the result of the initiative of Crawford, Harris, Kratochvil, and Jordan.



Chemistry east wing completed in 1971. Greenhouses in the foreground. Building #30 on the Campus Map. (Photo WEH)

In a general way, if a problem was not easily solved by other means, Gunning simply obtained more money and submerged the problem. In the context of the time, it was possible. Budgets did not begin to be slashed until the early 1970's.



### Lecture Series

For stimulation and scientific interchange it is important to bring renowned visitors to the department. In that connection the Boomer Memorial Lectures were established in 1959. Annually an eminent scientist is brought to the department as a Boomer lecturer to give a series of lectures. Similarly the Sandin lecture series was started in 1962 with a focus on organic chemistry. After his retirement the Gunning series was started in 1983. After his premature death the Birss lecture series was started in 1989. The Gunning and Birss lectures have their focus on physical chemistry. Now the Boomer lecturers alternate between the Inorganic and Analytical divisions. The Department also hosts many lectures given by invited speakers.

### Analytical Workshops

Dr. H. Habgood and I began our research collaboration involving gas chromatography in 1958. Dr. Habgood was employed at the Alberta Research Council (ARC). In 1959, with the financial support of ARC, we organized and made most of the presentations at the Alberta Symposium on Gas Chromatography. This was the beginning of annual spring workshops, particularly in the 1960's and 1970's, on topics of analytical interest that soon were organized by the Edmonton Section of the Chemical Institute of Canada. They were held in the Chemistry Department and over the years, the analytical staff members contributed heavily to both organization and instruction. Speakers have also been invited from other universities and from instrument companies. Attendance has typically been about 40. Topics covered in the period 1967 to 1977 were as follows:

<u>Year</u>	<u>Workshop Topic</u>
1967	Nuclear Magnetic Resonance
1968	Mass Spectroscopy

1969	Atomic Absorption Spectroscopy
1970	Gas Chromatography
1971	Data Acquisition and Treatment
1972	Infrared and Raman Spectroscopy
1973	Ion Selective Electrodes
1974	Atomic Absorption and Emission
1975	High Pressure Liquid Chromatography
1976	Chemical Applications of the Minicomputer
1977	X-ray Fluorescence and Energy Dispersive Analysis

### Publications

Research activities expanded rapidly in response to changes that were being made. Prior to 1958 the annual number of research publications from the department was in the range of 3 to 6. In the 5 years 1959 - 1963 there were 11, 20, 31, 42, and 76. The following table summarizes the rapid changes that occurred in the number of staff and research publications from 1951 to 1975. By this time the objectives we desired in the transition year of 1956 had been met and more. It has been said that the four keys to success are skill, patience, resources, and luck. We had them all.

Staff and Annual Publications, 1951 - 1975

Period	#Staff	#Pub/yr	Pubal/Staff/yr	Comment
1951-5	6.4	4.0	0.6	Before Gunning
1956 - 60	12.8	9.2	0.7	Gunning appointed 1957
1961 - 5	26.6	83.4	3.1	Gunning Head
1966 - 70	34.2	115.8	3.4	Gunning Chairman
1971 - 5	40.2	142.2	3.5	Gunning to 1974

The preceding table shows that from the 1950's through the 1970's there was an upward trend both in the number of publications from the Department and in the

annual number of publications per staff member. There is another factor, the average number of pages per publication. In 1957 the average publication from the Department had 6.0 pages, in 1975 it was 7.3 pages. In a general way the increased number of pages would indicate a trend for more substantial publications. However, length and significance do not always correlate. Brief publications can be of high significance.<sup>18</sup>

### 3.3 GUNNING APPOINTMENTS - EDMONTON<sup>19</sup>

R.N. O'Brien, physical, 1957 - 67.

H. B. Dunford, physical 1957 to retirement.

W. A. Ayer, organic, 1958 to retirement.

D. Darwish, organic, 1958, died 1973.

G. R. Freeman, physical, 1958 to retirement.

P. Kebarle, physical, 1958 to retirement.

L. H. Cragg, physical, 1959 - 62.

F. W. Birss, physical, 1959 died 1986

R. U. Lemieux, organic, 1961 to retirement.

K. R. Kopecky, organic, 1961 to retirement.

W. A. G. Graham, inorganic, 1962 to retirement.

C. Bigelow, physical, 1962 - 65

W. Poesche, organic, 1963-65.

Y. L. Chow, organic, 1963 - 64.

G. M. Schmidt, physical, 1963 - 64.

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<sup>18</sup> For my first 40 publications the average page length is 7.7. My lifetime most important publication (excluding books) was "Amperometric Titration of Mercaptans" It is a single page. It became a Citation Classic.

<sup>19</sup>Retirements mandated at age 65 by the University

## Errata

1- The manuscript for the history/memoir was submitted to the printer on a computer disk. On one page the printed version differs from the material on the computer disk. The Equation on Page 157 should be

$$D_{27} = 100(\Sigma_{top\ 27\%} - \Sigma_{bottom\ 27\%}) / 2(\Sigma_{maximum\ 27\%})$$

2-Page 121 Apology to Dr. Buriak, it is J. Buriak.

3- I regret I misspelled Kolthoff on Pages 43, 46, 129 and in Appendix 1 A.

O.P. Strausz, physical, 1963 to retirement.  
D. D. Tanner, organic, 1963 to retirement.  
S. Fraga, physical, 1963 to retirement.  
J. S. Martin, physical, 1963 to retirement.  
R. G. Cavell, inorganic, 1964.  
A. H. Kalantar, physical, 1964 to retirement.  
J. W. Lown, organic, 1964 to retirement.  
S. G. McGeachin, organic, 1964 - 68.  
G. J. D. Peddle, organic 1964 - 70.  
S. Masamune, organic, 1964 - 78. ( To M.I.T.)  
J. Hooz, organic, 1965 Died 1989.  
R. B. Jordan, inorganic, 1965.  
J. A. Plambeck, analytical, 1965 to retirement.  
David Hall, physical, 1966 - 68.  
B. G. Kratochvil,, analytical 1967 to retirement.  
J. E. Bertie, physical, 1967 to retirement.  
W. R. Thorson, physical, 1968 to retirement.  
M. J. Bennett, inorganic, 1968 - 75.  
S. Huzinaga, physical, 1968 to retirement.  
G. Horlick, analytical, 1969.  
R.E. D McClung, physical, 1969 to retirement.  
D. L. Rabenstein, analytical, 1969 - 1985. (To U. Calif.)  
M. J. Robins, organic, 1969 - 1986. ( To U. Utah)  
G. Kotowycz, physical, 1970.  
B. L. Clarke, physical, 1970 - 1997.  
A. J. Jones, organic 1970 - 74.  
H. J. Liu, organic, 1971 to retirement.  
J. Takats, inorganic, 1971.  
B. R. Hollebone, inorganic, 1971 - 75.  
R. S. Brown, organic, 1974 - 1995. (To Queens U.)

### Scientific Genealogy

In 1974, Frank Cedar, a graduate student in the department, published the results of a study<sup>29</sup> of the chemical genealogy of the then current members of the academic staff. Scientific genealogy trails converge to a surprisingly small number of ultimate scientific ancestors. Thus, Cedar stated that our physical chemists could trace their ancestry back to Wilhelm Ostwald (Nobel prize in 1909). Most organic chemists can trace their origins back to J. J. Berzelius of Sweden in the early 1800's. The father of analytical chemists and of modern chemistry was A. L. Lavoisier (1743 - 1794) who was beheaded in the French Revolution. The center of chemical activity traveled from Sweden and France to Germany, England, and then North America. In Canada, Otto Maass developed the first graduate school in any Canadian science. He was an ancestor of several physical chemists on the staff of the Department.

My chemical ancestors going back in time were I. M. Kolthof (Feb. 11, 1894 - March 4, 1993), N. Scherer (1872 - 1942), C. deBruyn (1857 - 1904), A. Franchimont (1844 - 1919), C. A. Wurtz (1817 - 1884), J. B. Dumas (1800 - 1884), L. J. Thenard (1777 - 1857), A. F. de Fourcroy (1755 - 1809), A. L. Lavoisier (1743 - 1794).

### 3.4 STYLE OF OPERATION

For so much change to be brought about in a scant few years meant that inevitably some things would not

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<sup>29</sup> F. J. Cedar, *Chemical Genealogy*, *Chemistry in Canada*, 26:38 (1974)

develop as anticipated and adjustments would have to be made. Gunning made 45 academic staff appointments; not all resulted in long term employment. I am not aware that he terminated any academic appointment on the basis of an adverse tenure decision. Of the original six members of 1956, Morrison left quietly after a year. Whether it was a Gunning-assisted departure cannot now be known.

At the beginning, graduate students were scarce and Gunning tried to retain as many as possible. Wallace had a graduate student who was unsuitable, but was persuaded by Gunning to retain him. Eventually, a thesis was produced that was judged unacceptable for a PhD by the external reviewer. Freeman and some others, through heroic efforts, produced material that gave the student a PhD. Soon afterward (the 6th year of the Gunning era), Wallace resigned and the Department lost a productive staff member. One can only speculate why he resigned. Did he feel he had let the Department down? Did he conclude that he had been forced to compromise his standards in giving a PhD to an unacceptable candidate? Was it because of the differential treatment he received as a pre-Gunning staff member?

When there were several full professors in the Department, Gunning sent ballots for them to vote in favor or otherwise for tenure for junior staff. He set up a rule that to grant tenure to a new staff member there must be a 75% favorable vote from the full professors. The opinions expressed were nominally anonymous but the ballot return envelopes were coded and were not secret. Over the years, a

meeting of full professors was called on two occasions to discuss specific tenure cases prior to the balloting.

Each of us has a certain style of operation. The Gunning style might be described as sequestered. His secretary was behind a closed door. His office was behind another door. Behind yet another door was his inner sanctum. Hidden switches were on the doors so that if a door was opened there was a private buzzer signal. At the informal Gunning Wake in December 2002, Tanner told us about a special hidden buzzer that only a few individuals (primarily Gunning's graduate students) knew about. They could use it to obtain direct access to Gunning.

Gunning attempted to free us from the distractions of University politics. He said that he would take care of external matters - we should focus our energies on research. When Gunning made arguments in support of some position he had adopted, he would on occasion stretch facts - use arguments of convenience.

## 3.5 ANALYTICAL CHEMISTRY CHRONICLE

### 1950's Situation

Following WWII, in the late 1940's and early 1950's, university enrollments skyrocketed not only at Alberta but also at universities generally in Canada and the U.S. There



was a scramble for staff<sup>21</sup> to carry out chemistry instruction. The staff shortage was the most acute in analytical chemistry. In many universities physical, inorganic or organic chemists were conscripted to teach traditional analytical chemistry courses. With growing enthusiasm chemistry staff rationalized that they would have better departments if they dismantled analytical chemistry as one of the four branches of chemistry.

### Dismantling

Harvard abdicated leadership in analytical chemistry when J.J. Lingane retired. MIT had two eminent analytical staff, D. Hume and L.B. Rogers. Hume was a star graduate from the Kolthoff School. Kolthoff planted his superstars in prestigious universities: Lingane in Harvard, Lautinen in Illinois, and Hume in MIT. According to a graduate student of Hume, (Tom Gilbert of Northeastern University) Hume was given a raw deal by MIT (confirming what I knew to be so). Hume was marginalized when MIT closed the analytical area. Rogers was encouraged to leave and went to Purdue. Minnesota, which had become the world's premier center of analytical chemistry with I.M. Kolthof, now simply eliminated the division completely when Kolthof retired. Unfortunately at Minnesota it had been largely a one-man show in analytical chemistry.

Canada followed suit to the extent it could. The University of Toronto had a tradition of excellence in analytical chemistry. It was the leading center with F. Beamish the only one in Canada directing PhD students in the field. When Beamish retired, the Head of Toronto Chemistry eased out the up and coming two young analytical chemists. W. McBryde went to the University of Waterloo and J. Page to Queens University. In Western Canada the most aggressive negative (English)

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<sup>21</sup> Details were given in "Recent History of Academic Analytical Chemistry" June 1989, A presentation by W. E. Harris to the CIC conference, Vancouver, B.C.

attitude toward analytical chemistry came from Dr. C. McDowell at UBC. He claimed that all chemists were analytical chemists (analysts maybe but not analytical chemists - WEH.) At one time, he had 25 physical chemists on staff but appointed not one analytical chemist in his lifetime as Chairman. Leo Marion of the National Research Council and Editor of the Canadian Journal of Chemistry also had an aggressive negative bias about analytical chemistry. In Canada, Dalhousie University with Dr. D. Ryan was a major exception to the dismantling.

Comment: Why, in the 1950's, were so many hell bent to go on the path of destruction of analytical chemistry? I was aware of what was taking place in many U.S. and Canadian universities. Even though R. McIntosh had given me warning and advice in 1957 (Introductory section of Appendix I, B), in my optimism I assumed that I would not have to deal with destructive attitudes in my home department.

### Gunning's Attitude

In the late 1950's Gunning's approach to analytical chemistry mirrored that in the general U.S./Canada arena. Gunning was a protégé of A. Gordon at the University of Toronto where in the 1950's a demolition of their analytical chemistry had been carried out. During my leave of absence Dr. Allen kept me informed about ongoing developments in the University of Alberta Chemistry Department. Evidently in a November 1957 Department meeting Gunning announced that curriculum changes would be made that would relegate analytical chemistry to mainly a minor role in the freshman chemistry course. Sandin and Morrison then piled on to attack analytical chemistry and repeated their vicious personal attacks of O. J. Walker. (Walker was retired and therefore not at Department meetings). Allen spoke up and also did some lobbying in defence of rationality.

On my return in 1958 from the year's leave of absence it was clear that Gunning intended to follow the example of the University of Toronto but had not yet made the curriculum changes. During the next two years he made generalized disparaging remarks about Analytical Chemistry - not personal. Did he think that analytical chemistry was not pure enough? During the next several years he made 21 appointments in Physical, Inorganic, and Organic chemistry but none in Analytical chemistry. Fortunately his procrastination continued with respect to making the fateful curriculum changes.

### The Challenge

In 1958, it appeared that the Division of Analytical Chemistry would be eliminated unless appropriate evidence would be provided that it was wrong to do so. Of course, the future of the Analytical Division mattered to me personally, and as I saw it a Division of Analytical Chemistry was vital to the health of the Department.

How should the challenge be met? Gunning stressed research to the exclusion of almost everything else. Normally, to remain in the Department, staff members were expected be productive in research. However, could analytical chemistry be expected to be viable for the long term if the focus was solely on research? At the University of Toronto Beamish was renowned for his research on the platinum metals group. However, that did not suffice to save their analytical division. The pillar of research alone could not be enough. Certainly also to expect Analytical

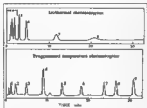
chemistry to survive on the basis of superior teaching would be a mistake - again that single pillar would not be enough. In any event I wanted both productive research and superior teaching in the Analytical Division and in the Department. The conditions in the Department were now superb for both aspects. Both responsibilities received as much attention from me as I could give them.

On the research front, my gas chromatography and polarography studies went well during the following years. In gas chromatography (Appendix I, C) I collaborated with Dr H. Habgood of the Alberta Research Council (ARC) and in 1962 we were invited by John Wiley Publishers of New York to write the book on the subject of our research. In 1961 at a conference of the American Chemical Society in New York City I had made a presentation concerning some of our work on the theoretical foundation of temperature programming. This is a speculation, but that talk was well received and may have triggered the 1962 invitation. We wrote the book - the first research-based book to be published from the Department. A comparison of temperature programmed and isothermal chromatograms is shown in the figure. Temperature programming greatly extends the applicability of gas chromatographic separations and analyses



H. Habgood, 1964. Physical chemist. PhD U. Michigan (Photo WEH files)

Positive student responses to changes made in the teaching of the introductory analytical course took place faster and better than hoped (Appendix I, C). In the Department there were soon many student goodwill ambassadors extolling the value of analytical chemistry. I am convinced that the highly positive student opinions helped later to secure the future place of analytical chemistry in the Department.



isothermal and temperature programmed chromatograms of a wide boiling range mixture. (From W.E. Harris, and H. W. Hibgood, *Programmed Temperature Gas Chromatography*, John Wiley New York, 1966, page 10.)

At my first meeting with Gunning in 1958 I was asked to present a seminar on my earlier research. It was the kind of demand that was not made of other members of staff. For me it was a hurdle but also an opportunity. In 1965 I was again asked to make another research presentation - a final hurdle and opportunity? I talked about the theory and practice of programmed temperature gas chromatography. The talk went well and I think that was when Gunning accepted the place of Analytical Chemistry in the Department - about a decade later than for the other divisions. I am grateful he did change his mind.

The building of the Analytical Division was now supported with further analytical chemistry appointments. I

was able to catalyze the addition of Dr. B. Kratochvil to the analytical division in 1967. That appointment made a world of difference in that he became a resourceful colleague in the analytical area. Two years later another opening was made available for an analytical chemistry appointment. Dr. G. Horlick and Dr. D. Rabenstein were excellent candidates to fill the position. Gunning authorized both. With those two new appointments the Analytical Division had enough members so that it was now viable.

In 1972, there was an incident with respect to the tenure ballots concerning Rabenstein and Horlick. It was only the second time Gunning had called a special meeting of the full professors to discuss tenure candidates. These two appointees were first rate teachers and excellent researchers whose work has garnered several awards nationally and internationally. A couple of physical chemists led by W Thorson seemed to have decided that these candidates were unworthy of tenure. He had been at MIT at a time when Hume and Rogers were being given a raw deal at that institution. If they united the physical chemists could easily outvote the analytical chemists in the tenure balloting process. I could not ignore the situation. At the meeting I presented a case for favorable tenure votes. I attempted to counter the opposition with excellent letters from outside experts. In a nutshell, the case against tenure seemed to be that the candidates were in analytical chemistry. It seemed that their kind of work was deemed as not tenurable. Were they really inferior colleagues with marginal scientific purity? Or was it simply a holdover of the attitudes from the mid fifties? I could not imagine two more worthy cases

for me to have to defend for positive tenure decisions. In the event they obtained tenure and continued to make major contributions to the Department.

### More Broadly in Canada

The climate in Canada for analytical chemistry continued to be cloudy for many years. At Alberta the analytical battle had been won by the mid 1960's but that was not yet so for Canada as a whole. It was important for the health of our Analytical Division that there be other viable centers of analytical expertise in Canada. Without question an important event in the recent history of analytical chemistry in Canada was the 1969 Analytical Symposium organized by Dr. R. Zienius following the 1969 Chemical Institute of Canada (CIC) conference in Montreal.

In some ways the Zienius Symposium was a council of war with a spirited and refreshing interchange of information by those interested in the place of analytical chemistry in Canadian universities. A number of position papers were presented. One person concluded that he should apologize for being an analytical chemist. He said for respectability "I call myself a physical chemist." During the challenge at Alberta I had been gathering data on the when, who, what, and how questions concerning the teaching of analytical chemistry. I presented my conclusions at the symposium<sup>22</sup>. The 1969 symposium was followed by two more. They helped set the stage for change during the

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<sup>22</sup> W E. Harris, "Teaching Analytical Chemistry - a need for Objective Data," *Analytical Chemistry*, 42, 43A - 62A (1970) and W E. Harris, "An Analysis of Teaching," *Analytical Chemistry*, 47, 1046A - 1052A (1975).

following years. Analytical chemistry in Canada began to rise from the ashes. Recounting of the experience at the U. Alberta helped in the revival<sup>23</sup>.

In the late 1970s when I was a member of the Canadian Council of University Chemistry Chairmen, I took perverse pleasure in needling the Chairmen from the University of Toronto and UBC about their crippled departments with no analytical chemistry staff. The University of Toronto, and after the retirement of McDowell, the University of British Columbia began to make appointments for analytical staff in a reversal of their earlier actions. Across the border in the U.S an analytical division was also revived at the University of Minnesota.

### 3.6 FORAY INTO UNIVERSITY POLITICS

This section is of personal interest to me as an example of the role that a chemist can play in the university. It is now somewhat amusing to recall some of the details.

#### Committee on Procedures

In 1966 a new Provincial Act was passed regarding the operation of the universities. At the University of Alberta there was to be a new General Faculty Council

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<sup>23</sup> A decade later, as partial fallout from the 1969 symposium I received an honorary D.Sc. from the University of Waterloo in which the citation indicated that the honor was being bestowed in recognition of the leadership shown in Canada for analytical chemistry



(GFC) In late April the statutory members (including Deans) decided that the Faculty of Science should have 10 elected members to the new GFC. The Faculty of Science in turn decided that the Department of Chemistry should appoint one of the 10 members. At a meeting of the Chemistry Department, Gunning said one of our number needed to be selected. He was a member of the old GFC and he said it was a boring total waste of time. Someone nominated me for the tainted honor.

The first meeting of the new GFC<sup>24</sup> was scheduled for May 26 1966. I talked with Dr. W. Allen about my future duties as a member of the GFC. He commented that most everyone would come expecting to "play it by ear" and that I should not do the same. He suggested that a brief informal meeting be held with Dr. Ross (the Dean of Science) and the 10 science members. At that rump meeting we decided that we should recommend that GFC appoint a committee to guide the council in its adaptation to the new Universities Act.

I went to the first meeting a few minutes early<sup>25</sup> and soon saw that many of the long time members of the previous GFC clearly had their favorite seats - their comfortable pews - in a classroom in the Electrical

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<sup>24</sup> Footnote 2, Page 444.

<sup>25</sup> I was greeted by a derisive "you" from Dr. A. Reeves in the tone of "look what the cat has dragged in." He was the head of the Education Administration Department. I knew him slightly and thought he was arrogant and non-collegial. A colleague of his described him to me as arrogant and mean - cruel.

Engineering building. V.P. Max Wyman opened the meeting with some general remarks and indicated the need to get on with the full agenda for the meeting. With some impatience he responded to my raised arm, at which time I moved that a Committee on Procedures be appointed to help guide the faculty in its adaptation to the new act. It was seconded by another member from Science. After a little discussion the Recommendation was accepted. How many members? With conviction<sup>24</sup> I said four. Who should they be? Immediately someone nominated me to be a member. Then L. Green an expert in international law from Political Science and Dr. E. Daniel from Pharmacology were nominated. Dr. A. McCalla, Dean of Graduate Studies seemed to have suspicions about anything useful coming from a committee that included those two and with the air of a martyr he consented to be the 4th member. The Committee was established.

The distraction having been taken care of, Wyman again indicated that there was much business to be handled and that we needed to get on with it. Discussion of the first agenda item went on for about a half hour. The members were "playing it by ear" and a conclusion was not becoming obvious. As the discussion continued, I wondered what's up? Finally the light came on in someone's head with the suggestion "this item should be referred to the Committee

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<sup>24</sup> On this question I had no doubt at all that it should be four. I again thank Allen for peerless advice. To obtain good sound recommendations from a small committee, it must be a committee of four free thinking individuals; never a committee of three or five. A decision coming from a committee of 4 cannot be the result of an opinion worse than a 3 to 1

on Procedures". Then the next item - again more playing it by ear but now in just a short time "refer this to the Committee on Procedures" From that point on the Agenda items collapsed one after another and the meeting became short and mostly referred to the Committee on Procedures. The now short meeting was postponed for one week at which time the new committee was to bring in recommendations.

The members of the Committee on Procedures met immediately in McCalla's office. There, McCalla came to me before the other 2 arrived and said "You must be the committee Chairman" When Green and Daniel arrived he said in an authoritative voice "I recommend Walter be our Chairman." There was no disagreement.

Green talked loudly and had strong opinions, Daniel, (President of the Staff Association), had a bit of a reputation for stirring up discussion, and McCalla was stubborn as a mule. It turned out to be a good committee. None of us held anything back - strong willed but not obstinate. We were committed to getting the job done and there were no personality clashes. We met again on Monday, Tuesday, Wednesday and Thursday of the next week formulating recommendations with free ranging discussion. When we had split opinions and an impasse about an item we simply postponed the item for future consideration and carried on. We had several items from the shortened GFC meeting. Green made a suggestion that the first recommendation should be to the effect that no changes in the Act be proposed until we have had a chance to see how the Act

operates. I wanted the proceedings to be open which led to recommendations that copies of GFC agenda be circulated to all full time staff, and that Minutes be circulated to all GFC members and to others who request them.

The all-day meeting on Friday June 2 was called for 9 a.m. Well before the meeting I went into the room and rearranged the movable seating to create an impression that we now had a new GFC. Favorite seats were no more. We had 23 recommendations to bring forward - all of them were 4 to 0 decisions within the committee. I was asked to report on behalf of the committee. It was agreed to consider the recommendations in turn and to vote on each separately. The recommendations were presented by stating the problem, question, or concern, our recommendation, and briefly the pros and cons to ignite discussion. The motion was then open for discussion and finally the vote.

For one of the very first recommendations discussion erupted like gasoline thrown on a fire. With an argumentative group of about 50 academics one cannot expect much to be accepted without challenge. The discussion closely mirrored what had taken place in our committee. After much airing a vote was called for and our recommendation carried by more than a comfortable margin. On to the next one - background - recommendation - pro/con - discussion - vote. So on it went hour after hour. With a break for lunch, the marathon continued to about 4:30 when the last of our 23 recommendations had been put forward, discussed and voted. Throughout the day the other three members of the Committee on Procedures

maintained silence or nearly so. I don't recall that they attempted to defend any of our recommendations. Possibly their silence had a daunting effect. The votes for the recommendations were: carried, carried, carried, carried, carried, carried, carried, carried, carried, carried, carried, carried, carried, carried, carried, and carried. That must surely have set a record for agreement for this university. Every recommendation was passed with no amendments, no changes of sentences or words. W. H. Johns, in his book on the history of the University, wrote "*All these recommendations, which Dr. Harris put forward with great clarity and conviction, were approved.*"<sup>12</sup> If I did put them forward with conviction, that conviction arose from the knowledge that every recommendation was the unanimous opinion of a 4-person committee and not a split opinion that might be expected from a three or five member committee.

During the next two years two or three dozen more recommendations were presented on behalf of the committee. Some items required us to come back to them several times before we evolved and formulated an agreed on recommendation. By the time we had chewed on them and were able to formulate them, probably all were 4 to 0 decisions. There began to be an air of irresistibility about the

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<sup>12</sup> Dr Johns added a footnote to his book (Footnote 2, Page 448) as follows "Dr Harris informed me recently that after the week of intensive work he and his committee had put in on framing these recommendations and after the nervous strain of presenting them to GPC over a period of hours, he sat down in his seat and promptly went to sleep from sheer exhaustion."

committee - what we recommended was always supported. Since I was the one most visible it resulted in a disproportionate amount of the credit to me that belonged to a committee of FOUR persons. It was a heady experience and there were some interesting consequences.

### Unforeseen Consequences

My visibility on the campus was increased because of my role in the new GFC. There were several results. (1) I received many informal "on the street" compliments about my role in GFC. (2) McCalla and Dr. H. Kreisel over a period of three weeks attempted to persuade me to join them in the Dean of Graduate Studies office. There were too many things I wanted to do in chemistry, however, and I did not wish to get into administrative work. (3) Dr. Sam Smith who was to become the new President of the University of Lethbridge attempted to persuade me to become the Dean of Arts and Science there. (4) GFC had to elect someone to become a member of the Board of Governors - I was nominated and so was Dean Ross. Ross won the election for which I am grateful. (5) Years later possibly another result involved the election of one member from the entire academic staff to be on the committee to recommend a new President. There were University wide nominations followed by two ballots, the first to determine the six with the most votes, and the second ballot to determine the one to be elected. I was elected.

At the fall meeting of the Association of Academic Staff in 1968 President Johns was invited to talk to the assembled staff. During his talk he praised my role in GFC.

The next day Gunning called me into his office where I was quickly brought back to earth - without a parachute! He had read copies of GFC minutes. He was obviously hot under the collar about what had been going on in GFC and my role in it. Possibly he now regretted that he had not continued to free us from the distractions of university politics. He seemed to think I with the Committee on Procedures was causing ruination, though it was not clear to me how. I was surprised by his reaction and declined to admit any wrong-headed damage from my role in GFC. The "interview" ended when he instructed me to appear before a special meeting a week hence of the academic staff of the Department. A couple of days later he sent a two page letter to all the Chemistry academic staff and to all Deans in the University concerning what he considered the current objectionable operations of GFC.

A week later, I was at the Department meeting where I was to justify my actions in GFC to my colleagues. Sandin, though retired, was also there. I described what had gone on, who was involved, what recommendations were made, the discussions, and the openness. The event probably lasted a couple of hours and included many questions.

Finally, the Star Chamber proceedings seemed to just wind down, wither and die. After the meeting I sat in my office settling my nerves. D. Darwish, a Faculty member in Organic chemistry, came into my office, said not a single



Dr. Darwish. Deceased in 1997. (Photo R.J.C.)

word, shook my hand and walked out. That was the most heart-warming of congratulations. No one else "commented". Gunning never brought the subject up with me again nor did anyone else. A decade later there was a sequel. G. Baldwin, Dean of the Faculty of Arts had retained and remembered the letter and used it in GFC<sup>28</sup>.

### 3.7 RECOLLECTIONS

#### Dr. R. Lemieux

The 1999 book<sup>29</sup> *Echoes in the Hall* has several dozen articles that describe many aspects of the history of the University along with anecdotes about what life was like in the mid century. One of particular interest to chemists is the report of the interview with Dr. Lemieux (p. 282–296) "The Boy from Lac La Biche". When he was young, Lemieux wanted to become a professional hockey player but he was too small. The lectures given by his first organic chemistry instructor, Archie Gibbs, led him to want to be a chemist.



R. L. Lemieux – Sugar Ray  
(Departmental photo)

<sup>28</sup> There was a GFC sequel. I was told that years later at a meeting of GFC when Gunning was President, Dr. G. Baldwin the Dean of Arts who had retained "the letter" read a passage from it to refute, with Gunning's own earlier words, a current argument that Gunning was now making

<sup>29</sup> *Echoes in the Hall*. University of Alberta Press, 1999, Edmonton. T6G 2E2.



Upon completion of his graduate studies, he became a staff member at the University of Saskatchewan, next at the Prairie Regional Laboratory, and then Head of the Department of Chemistry at the University of Ottawa. In 1960, he met Harry Gunning. Gunning asked Lemieux to help him find a top organic chemist for Alberta. The next day, Lemieux returned and told Gunning "How about me?" And so Lemieux came to the University in 1961. He built up a strong research group with graduate students and postdoctoral fellows. He organized much of the infrastructure of the department. In recognition of his research, he received numerous major national and international awards. One of the most notable was the Wolf prize conferred by the President of Israel. Another was the King Faisal Prize of Saudi Arabia.

### Dr. H. Gunning

Dr. Gunning made a submission to *Echoes in the Hall* entitled "Emerging from the Hinterland" (Pages 204 - 208.). He described the events leading to his appointment and how he proceeded to build up the Chemistry Department. He gives a great deal of credit to Dr. E. Steacie who was the President of the National Research Council (NRC). Steacie was a great scientist and statesman who had an excellent knowledge of the status of science and scientists in Canada. He had the confidence and support of those in the political realm.

Gunning had four years of postdoctoral studies in the Steacie group before going to academia in 1946. Steacie

wanted to help Canadian universities upgrade their academic capabilities. We had consulted Steacie for advice and suggestions for prospective candidates (Section 3.1) when we were looking for a new Head for Chemistry. Gunning states that Steacie had phoned and told him that if he accepted our offer he could count on complete support from Steacie in building up the academic stature of the Chemistry Department. Thus in 1956 unknown to us we had a powerful ally giving us help at a crucial time. Gunning did come and indeed Steacie did provide generous research funding from NRC.

In his submission Gunning commented on the myopic vision of President Stewart when he insisted that the future enrollment would never be allowed to exceed 5000. It is now 34,000! He further commented that the University was in good hands when Dr. W. Johns became President. With John's support, Gunning moved toward the development of a modern department. Gunning was an effective networker. *"I continued to have many meetings with members of the government and the University staff. Dr Steacie's goals had overwhelming support in every intellectual discipline in the University. I sensed a pride and enthusiasm among our best staff members. Building the University of Alberta into a leading intellectual center, capable of giving Albertans the most advanced education available and equipped with the best facilities for adding new knowledge in all fields, became a very dynamic institutional objective".*

Thus the University of Alberta began a transformation into a forefront intellectual institution. The

annual Boomer lectures were instituted in 1959 with Dr Steacie as the first lecturer. The following photograph was taken in 1967 when Dr. H. Frank was the lecturer.



Chemistry Department staff, 1967, outside the Chemistry Building. Left to right: H. E. Gunning, H. B. Dunford, P. Kebarle, D. Darwish, C. Bigelow, F. Bross, H. S. Frank (Boomer lecturer), W. E. Harris, R. N. O'Brien, G. R. Freeman, R. U. Lemieux, R. K. Brown. photo supplied by W. E. Harris).

### 3.8 SUMMARY OF THE ERA

During the period 1957-1974, Gunning made numerous academic staff appointments and by 1974 all of the 40 staff were Gunning appointees with only four exceptions - (Allen, Crawford, Davis, and Harris). The Chemistry Department had become a truly Gunning one. His emphasis was on research, and the academic staff were encouraged to enhance their scientific reputations and that of the Department. Gunning provided a supportive environment by taking care of administrative matters and the acquisition of resources and services needed for research and teaching. On a personal note, I remain grateful to have been able to work under the conditions during Gunning's

regime where my colleagues and I could pursue our goals. In 1956 the six of us had the goal of taking actions that would result in a stronger department and with Gunning's leadership our objective had certainly been attained. By 1974, increasing numbers of honors and awards were beginning to come to the maturing members of the staff.

In his 1957 report<sup>30</sup>, President W Johns said: *"In a very real sense, the University is moving out of one historical period into another, and when the history of the University is written in the future, 1958 will be recognized as a turning point "* His prediction was accurate. In the decade following 1958, Dr. Gunning had firmly established his legacy not only in the Chemistry Department but also in the wider University and beyond. After that first decade or so of intense building activity Gunning began to enjoy golf - unthinkable during the previous years.

Profound changes had been brought about but, inevitably, there were some unresolved problems. The management of teaching freshman chemistry was chaotic and there were inequities in treatment of the academic staff members. Most importantly, the future well being of the Department now seemed to rest too much on the shoulders of a single individual, which resulted in a pervasive feeling of continuing dependence on Gunning. As a result, when he was about to leave, among the academic staff there was a deep sense of pessimism about the future well being of the

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<sup>30</sup> *The University of Alberta, 1908 - 1983*, University of Alberta Press, 1982, Page 80.

Department. We really were not to become a rudderless ship when Gunning left the Department but there was deep anxiety nevertheless.

## 4 CONTINUING DEVELOPMENT

### Chairman Selection

After 17 years as Chairman of Chemistry Dr. Gunning would become University President as of September 1, 1974. Accordingly in January 1974, a committee was formed to select a new Chairman for Chemistry. It included the VP Academic (Dr. Kreisel) and the Dean of Science (Dr. Ross) as well as four others including me from the Department.

With his top-down mode of operation no one in the Department had been groomed to become the new Chairman. The four Divisional Chairmen had not been significantly involved by Gunning in departmental policies. We in the Department requested that the new Chairman to replace Gunning should be from outside. At the first meeting of the selection committee VP Kreisel did not accede to that request and said there are suitable internal candidates.

I was relieved of my committee duties. In late January, I was told that a petition had been signed by all the full professors<sup>21</sup> and by others with a recommendation that I should be the new Chairman. Up to this time, I had successfully avoided administrative appointments. I told my

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<sup>21</sup> The full professors were Allen, Ayer, Bertus, Birss, Cavell, Crawford, Dunford, Fraga, Freeman, Graham, Huzinaga, Lemieux, Kebarle, Kratochvil, Liu, Lown, Masamune, Strausz, and Thorson. A few months earlier and shortly before his death Dr. R. Brown came to me and with the deepest heartfelt entreaty told me I must become the new chairman.

wife Phyllis about the situation. Two professors, Freeman and Birss, went to visit her to talk to her about the petition. I was nearing completion of the writing of the Second Edition of *Chemical Analysis* and was in the middle of index preparation. I had been looking forward to a 6-month Sabbatical leave.

My first (in 1957-8 it was a leave of absence without pay). Dean Ross agreed that I could have a brief break later if I would consent to be the new Chairman and get started. I agreed to accept a term of five years provided there would be no extension. The appointment letter was April 9, 1974.



W. E. Harris, Chairman  
1974-1979

## 4.1 CHANGEOVER

In 1974, nearly all members of the department had been appointed by Gunning. They had little experience with broader university affairs. Their professional needs had been cared for by Gunning. It may now be hard for the current generation to understand that back then the dependence on Gunning was so complete that when he was about to leave there was a real sense of impending doom. However, the Department was now strong enough that a single forceful individual, or the loss of one, could not stymie our future. Nevertheless, it was a different generation and time. Almost all of us were concerned about the transition into our future and the Department was filled with a sense of uncertainty. I

think it is more than a coincidence that one of Gunning's first appointees now required a one-year sick leave.

I had no changover and advisory session with Gunning. In the early summer of 1974 the Chairman of the Chemistry Department of the University of Wisconsin was here as a thesis examiner. I had a good session with him and was able to obtain a lot of helpful advice from him about leadership at the Department level.

I could not really exude an optimistic sense that all will be well and the air of uncertainty remained. However, after three or four years it became clear that the Department had resumed its upward trend in teaching and particularly in research. I could then counter doomsday kind of remarks and indicate that really the transition was going well

I wanted sound decisions concerning appointments, tenure, salaries, and justifiable recommendations for promotion to the associate professor or professor levels. I wanted to maintain an adequate budget for departmental needs and in general to maintain conditions in the Department for continuing excellence in research and teaching.

In August - before the September 1, 1974 date - I called a Department meeting to meet with the academic staff and to indicate that my approach would be an evolutionary one. I would attempt to maintain conditions for effective research and teaching. I had no intention or wish to make big changes. I would uphold high standards for tenure and



promotions. The revolution had taken place about two decades ago. Now there would have to be consolidation and adaptation. I was grateful to inherit the entire infrastructure that had been put in place and had no wish to do other than carry on. Without the continuing support of the dedicated staff the Department could not have functioned. During my term as chairman many contributed to the success of the Department<sup>32</sup>. My deepest thanks to them and all others for their contributions over the years.

On becoming Chairman I needed to engage in unfamiliar activities. I needed to review or consider such matters as:

- The Departmental files
- The status of the members of the academic staff
- Tenure and promotions

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<sup>32</sup> They include APO's (Administrative and Professional Officer) Don MacKenzie, Arnold Adam, Ron Gardner, Gordon Weir, PSO's (Faculty Service Officer) Margaret-Ann Armour, Tom Davies, Alan Hogg, Tom Nakashima, Lou Browne, Norman Gee, and Bob Swindlehurst, and non-academic staff June Hill, Anne Morris, Clem Jordan, Dee Budd, Gladys Whitall, Rudy Kenwell, Frank Driessgacker, Ed Peschuk, Ron Cox, Hubert Hofmann, Ernie Young, Hubert Priebe, Leo Martin, Jack Ferch, Erich Scharfner Jim Hoyle, Diane Formanski, Darlene Marlow, Glen Bigam, Tyler Fitzgerald, Avron Levine, Tony Schnautz, Gordon McInyre, Lorne Harmon, Arnold Logan, Tyler Fitzgerald, Frank Fy, Lu Ziola, Diane Dowhanisuk, Jackie Jorgensen, Erica Schamedatus, Annabelle Wiseman, Margaret Adkins, Mary Waters, Lilian Eastman, Margaret Thompson, Selena Mah, Diane Mahlow, Cor Brusselers, John Toonan, Gerald Streefkerk, Theo Van Esch, Jerry Woytak, Tony Budd, John Oleczyk, Don Morgan, Tom Brisbane, Al Clement, Dorothy Cox, Anna Jordan, and Larry Coulson. I apologize for inadvertent omissions of those who contributed to the success of the Department during my term as Chairman.

- Research
- Teaching
- Appointments
- Internal relations
- External relations
- Advisory bodies
- Style of operation

Much of my time during the first weeks was spent examining records. Gunning had a love of books and was interested in a variety of topics. In the Chairman's office he left behind a dozen or so books in the realm of the supernatural or mystical. Why were they there and why had they been left?

## 4.2 ADVISORY

I was fortunate to have the continuing help of Associate Chairman Dr. Davis in a role in which he took care of many undergraduate and graduate student matters. I wanted help and advice from the Chairmen of the Analytical, Inorganic, Organic, and Physical divisions. No election of Divisional Chairmen had taken place for years and I called for a new election. After that election I sought and particularly valued the advice of Ayer, Bertie, Graham, and Kratochvil on matters of appointments, promotions, and salary increments.

My style of operation had to be one that was comfortable for me. I asked my secretary to leave her door

open and to leave my door open. If someone phones or asks to see me please put them through directly - don't ask their name or about their business. In general, I wanted to encourage communication. Hence, I soon initiated a weekly Chemistry Newsletter - a single 8.5" x 11" sheet every Friday concerning visitors, notices, exams, congratulations, news, and job postings. The Chemistry Newsletter has now been coming out every week without fail for 30 years.

During the 1970's the generous budget for the Chemistry Department as well as the University as a whole began to be reduced. That scaling back continued during my term as Chairman and afterward.

I depended on Don Mackenzie to keep track of financial matters. I adjusted to the budget pressures in part by eliminating some aspects of the two-tier system that had been developed. (Section 3.2) Later in my term I persuaded Dean Newbound from Science to appear with me before the Priorities and Planning Committee to make a case for improved financial support for the Department. In an effort to obtain support from the wider community an article appeared in the March 14 1978 issue of the Gateway entitled "Science hit hard by cutbacks, Chem dept. head outlines problems." In the article I gave details of the budget pressures brought about by inflationary and other pressures. President Gunning in his 1975 Report to Convocation said, (*The University of Alberta 1908 - 1983*, University of Alberta Press, 1982, Page 130.) "*When one examines at first hand the damage which has been done to our academic capabilities by four years of punitive financing, it becomes apparent that it will take at*

*least an equivalent amount of time of enlightened support to restore our academic vitality."*

I did not realize that some Departmental money could be used for what I choose to call special purposes. I talked with the Chairman of the McGill Chemistry Department, Leon St. Pierre (a former student), about departmental funding. He suggested that I should have a fund with few strings attached. He later sent a donation of \$200 to the Department and stipulated that it could be used in any way I wished. It took a long time but finally the Bursar's Office cashed the check to set up the Chemistry Research Trust (#06632). Money from several sources including other charitable donations has since been added to that fund and it is used to serve many Department needs with minimal red tape from bean counters.

I depended on Don Mackenzie to oversee most of the area of the Department dealing with non-academic staff. There was a long term problem in the supervisory position of the electronics shop. For years there was a revolving door aspect where new technicians came, stayed for a year or two and left. As a result, we always had mostly inexperienced staff in that unit. Dr. Graham helped with the solution to that long term personnel problem. With a new supervisor, the electronics shop now has personnel that remain with us year after year and provide experienced service to members of the department.

Sybil Ellis, Gunning's secretary, went with him to the President's Office. As Chairman's secretary I had Linda

Massey for the first half and Lorrie Pearson for the second half of my term. Both were exceedingly loyal and dedicated to the job and provided me with informal information about departmental affairs. During my first months there were research grants forms to be signed. The secretary had to assist with much of the associated paperwork dealing with the applications.

I appointed committees of 1, 2, or 4 persons to develop recommendations on behalf of the Department. I called two Departmental meetings per year. At the meetings, departmental committees reported their findings and recommendations. The meetings were called for 11 a.m. in the hope that the busiest members of the academic staff would attend knowing that the interruption of their other activities would not be for more than an hour.

Before becoming Chairman I worried about how to handle the superstars in the Department such as Dr. Lemieux. Such concerns were unfounded. For example, when I had a situation where I needed special advice I would call on Lemieux. He always had a fresh and unusual point of view and would do all that he could to help. In reality the worrisome ones were those at the other end of the scale from the superstars.

### **4.3 SALARIES AND PROMOTIONS**

In my first year as Department Chairman, salary and promotion (S&P) matters needed immediate attention. I

examined a number of the records and reviewed the kind of cases that Gunning had put forward for various recommendations concerning salaries and promotions. I would soon need to assemble similar information.

Three organic chemists, Drs. Hooz, Kopecky, and Tanner were at the top of the Associate Professor rank and they had to be considered for promotion. I wished that postponement for a year would be feasible and until I could get my bearings - no reflection on their worth. Postponement was not feasible and the collection of the documentation for their promotions had to proceed. For promotions a substantial amount of documentation had to be assembled, including letters of support from experts outside the university. The documentation had to be prepared prior to the meetings of the Science Faculty S&P Committee in early December.

For other academic staff members, information had to support conclusions and recommendations. A morale problem needed to be managed that may have stemmed in part from the fact that Dr Hollebome had been promoted to Associate Professor but had yet to acquire tenure while at the same time Dr. McClung was still at the assistant professor rank and had tenure. As a further complication, Drs. Horlick, McClung, Rabenstein, and Robins had been appointed the same year but all at different salaries. I tried to bring their salaries more in line with each other by recommending McClung for extra salary increments and recommending single increments for the other three

The deliberations of the S&P committee in the Faculty of Science were instructive. The files of all the candidates for promotion were available in the office of the Dean for study before the meetings. The recommendations of the chairmen of other departments could be examined ahead of time. In the Committee I seemed to be expected to inherit the leadership role that Gunning had been playing. The other committee members appeared to wait for me to be the first to raise objections in the instances of questionable recommendations. In the committee deliberations I questioned two instances of recommendation to promotion to professor. One of the promotions was supported and the other was not.

Rumors had it that game playing had been going on between the Chairmen of Physics (Dr Sample) and Chemistry in puffing up the credentials in support of recommendations. There was a practice to report research publications for individuals for a couple of years in succession by using phrases such as "in preparation" "submitted" "in press" in addition to information about completed publications. In the extreme case of the Mathematics department the lifetime list of publications was reported every year. In the second year I adopted the practice of reporting publications only once to the committee and only when they were complete with page numbers in a journal. When J. Macdonald became Chairman of Physics he adopted the same practice the next year. During my term I enjoyed collegial interactions with the Physics and other Science department chairmen.

## 4.4 APPOINTMENTS AND TENURE

I felt that I could not take continued responsibility for directing graduate student research in the analytical separations area and asked that an analytical chemistry appointment be made to cover that area. The analytical division and its Chairman Dr. Kratochvil considered candidates and recommended the appointment of Dr. Cantwell. With the advice of the divisional chairmen responsible the other appointments I authorized were of Drs. Clive, Cowie, Vederas and in 1979, my last year as Chairman, Pons<sup>30</sup>.

Late in my term a somewhat senior appointment was being sought in the Organic division. The Physical chemistry division had gone through some superstar appointments with questionable success in earlier years. What was being proposed now was another instance of an upper tier appointment (Section 3.2). I discouraged the appointment and wanted to move away from the 2-tier system in which some have lighter teaching loads or more access to departmental resources than other staff members.

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<sup>30</sup> Dr S Pons had been away from chemistry for about a decade and was anxious to make up for lost time. He worked hard and quickly submitted his research findings for journal publication. After four years he left and went to the University of Utah. On March 28, 1989 he announced (with M. Fleishman) that they had achieved sustained nuclear fusion at room temperature. Fusion fever spread quickly. Now cold fusion researchers are largely marginalized. In the end the scientific method will lead us to the truth about cold fusion and carry us forward.



On the matter of tenure, the rule that Cunning had developed was that to obtain tenure a new staff member must attain a 75% favorable vote from the full professors. The Departmental records showed that tenure had been granted in one case to an individual that was below that threshold. In view of an earlier tenure related meeting (Section 3.5) I was particularly interested in the data concerning Rabenstein and Horchek but found none for those or any other tenure cases.

Recommendations from Department chairmen concerning tenure were made to the Dean. On the matter of reaching a decision respecting tenure I wanted the opinions of the full professors and I intended to follow their collective advice. I sought legal advice through Dr. W. Allen, the Associate Vice-President Academic and it was to the effect that if an adverse tenure recommendation were to be



W. Allen, 1972

challenged I would not have appropriate legal support if the ballots were secret. I therefore asked the professors to sign their ballots. On this matter I had a disagreement with Dean Ross of Science but decided to act in accordance with the legal advice. I received advice from members of the staff that tenure decisions should be considered with care.

I had one tenure case to consider in my first year - Dr. Hollebone. He agreed that the tenure decision could be held

in abeyance for a year. We agreed to mutually seek advice from Dr. Birss on his return from sabbatical leave. The next year Birss did a demanding, extensive, and responsible review of the case and wrote a long report. Upon receipt of the report Dr. Hollebhone resigned. Dr. Birss ended with a stay in the hospital, I think as a result of the personal stress he had undergone in the process.

## 4.5 RESEARCH AND TEACHING

As chairman I inherited a teaching problem to manage particularly with respect to freshman chemistry. For years Dr. Birss and later Dr. Bertie had overseen the planning of the lectures and laboratory out of a sense of community responsibility. There were several lecture sections and they needed to be coordinated. I appointed a small committee to consider the situation and make recommendations for future coordinators of freshman chemistry. That committee developed recommendations with respect to freshman coordinator for the next 10 years. Dr. Thorson agreed to be the new Coordinator and take on the job for a 2-year period. He would be relieved by Dr. Rabenstein and so on.

Teaching in chemistry mostly involves students who do not have the objective of being professional chemists but who intend to become engineers, doctors, pharmacists, agriculturists, and so on. My first meeting as the new Chairman was with the Head of Home Economics, Dr. Beth Empey. Her concern was with the difficulty of freshman

chemistry for some of her students. Another early interview was with Dr. M. Bennett who had been appointed in 1968 and had been on sabbatical leave during 1973 - 4. Mike was clearly distressed that he had not obtained the sort of rejuvenation that he expected during his leave. He seemed to conclude that he had let the Department down. He said that he must resign. I could not persuade him otherwise and we lost him as a staff member.

In a broad context, when attempting to arrive at recommendations concerning salaries and promotions, should recommendations be based mainly on the teaching competence or mainly on research activities? How do the two functions of teaching and research relate to each other? I needed to understand more about such questions. This is an area with an acute shortage of facts and one filled with rhetoric and speculation.

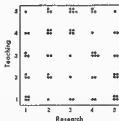
### **Perceptions and Reality**

There are a couple of common perceptions. One is that paying attention to teaching interferes with research and therefore the correlation coefficient between teaching and research could, in the limit, be as low as -1. The other is that high competence in research endows one with competence in teaching and the correlation coefficient could approach the limit of +1. Probably no sharp dividing line can or should be drawn between the inseparable functions of research and teaching. Nevertheless it was important for me to know how teaching and research activities are related.

I obtained information from the University of Alberta Chemistry Department and a couple years later I also obtained a good knowledge of the Chemistry Department at Arizona State U. while Visiting Invitational Professor there. For tenured staff I used public and confidential information and opinion to rank 65 midrange and senior staff on a 5-point scale as to research productivity and independently as to undergraduate teaching competence with 1 the lowest and 5 the highest ranking. I also asked two informed colleagues to give me their independent conclusions. The diagram below shows the result of our combined judgments. Each dot represents one individual. Calculation of the correlation coefficient shows that it was neither positive nor negative but actually 0.0 for this group of 65.

Avoid over-interpretation of the diagram, but look at the upper center part. It indicates that in general the most competent teachers are active in research at a good level. The individuals who excel in both categories are rare. Only one individual of the 65 was ranked in the 5th quintile in both teaching and research. Also only one in 65 was in the 5th quintile in teaching and the lowest quintile in research.

Another observation is that sometimes the most highly productive researchers rank low on the teaching function. I concluded that in a university the objective is research AND teaching not research OR teaching.



## 4.6 PDFs - SENATE EVENT

Unanticipated matters do arise that must be handled urgently and fairly. Usually they can be managed quietly but not always. In February 1976 I was asked to appear before the University Senate to explain a purported exploitation of postdoctoral fellows by the Chemistry Department.

First, I provide some general background. During the mid-1970s the Chemistry Department continued to have about 50 Post Doctoral Fellows (PDFs) on appointments made by staff members with their research grant money. PDF appointments are usually for two years and involve recent PhD graduates. A PDF appointment should be mutually beneficial to the PDF and the staff member. A PDF has enormous freedom to do much or little. However, the appointment provides an opportunity to enhance scientific stature while collaborating with a more mature scientist. Since 1957 the Chemistry Department has maintained vibrant excellent conditions for those interested in research. Most PDFs come from foreign countries and are on visas. The international exchange aspect of PDF appointments is important. Normally at the completion of a 2-year appointment a PDF goes on to permanent employment. Some PDFs may seek a second 2-year PDF appointment, but those who continue in the PDF mode for more than 4 years may expect little further enhancement of scientific stature as a result. Three decades ago there was a problem in that the number of PDFs in Canada and elsewhere exceeded the number of academic and other openings by a substantial margin. Understandably then, some PDFs had difficulty in finding suitable permanent positions after a 2 year PDF appointment.

The unforeseen request by the Senate to appear before that body needed to be handled. What had been going on? Two PDFs had played a leadership role in the formation of a chemistry department PDF association. One of the two attended the Garneau United Church. He complained about PDF exploitation by the Chemistry Department to the Rev. V. Wishart. Rev. V. Wishart was a member of the Senate and brought the PDF complaint to the attention of the Senate with a phone

call on January 23/76. In a letter to the Chancellor on February 2/76 he wrote in part that "I have been following with growing concern the grievances of the Association and their attempts to rectify the situation.". The PDF Association had later made a presentation to the Senate.

The Senate set up a task force on "The Post Doctoral Fellow in Chemistry"

*"That Senate ask the Executive to establish a committee to look into the immediate problem of the post doctoral assistants and fellows and to take what action it sees fit, with particular reference to their status as employee, their compensation, and their benefits . and the role the Senate should play in considering the larger questions raised by the lack of employment opportunities."* (For the record, the chemistry academic staff had PDFs but no Post Doctoral Assistants).

I had to wonder why I had been out of the loop. Why had no PDF talked to me, why had Rev. V. Wishart not consulted me about his growing concerns, why had I received no copies of PDF briefs, why did no staff member seem to be aware that the PDFs wanted the help of the Senate to force the Department to provide employment? How should I prepare for the Senate hearing?

A meeting was arranged involving PDFs and several of the chemistry academic staff. Dr W Thorson was especially helpful in the discussion with the group. The PDFs wanted employment. In a nutshell, what did the PDFs hope that the Senate would do? (Answer: require Chemistry to provide employment.) Could the Chemistry Department provide employment for the PDFs? (Answer: no.) Though we regretted the current tight job market we could not fulfill their wishes. At a subsequent meeting of the academic staff the following motion was passed unanimously and sent to the PDF Association: *"That the academic staff of the Department of Chemistry affirms the principle that a postdoctoral fellowship is an aspect of professional training and should not be considered employment"*

An all-day meeting (March 24, 1976) of the Senate was arranged for the PDFs to present their case and for me to present the position of

the Department. As observers, Dr J. Bertie (Chairman of the Physical Division) and Dr. W. Graham (Chairman of the Inorganic Division) accompanied me. In my extensive presentation I explained the purpose and place of PDF appointments in the education of professional chemists. The final item in my presentation was to read the names of the then 49 current PDFs and how long each one had been here. The median time was 12 months. From the group of 49, 46 were in the Department for 21 months or less. The three exceptions were at 24, 28, and 38 months.

At the end Chancellor R. Dalby called for a vote from the Senate members (about 30). The vote was nearly unanimous in support of the Chemistry Department. Rev. V. Wishart and the student member of the Senate voted in opposition. For the Senate final report Rev. V. Wishart submitted a Minority Report.

After March 24 1976 the Department continued to provide excellent conditions for research by PDFs and others. We wished the PDFs well and hoped that they could move on to successful futures. After a few months the PDF that had complained to Rev. V. Wishart left for Brazil. The other leader left for a job in Ottawa. A third one, an outspoken Brit, on a visa PDF went to an appointment in Germany. The other significant person in the PDF Senate event, Rev. V. Wishart moved on from Garneau United Church. I found it more than interesting that in the spring of 1977 at a social gathering, in connection with the annual meeting of the CIC in Winnipeg, two PDFs from U. Alberta at the gathering were totally unaware that there had been a PDF controversy. In just one year the controversy had become ancient history and forgotten.

With thanks I acknowledge that Sandra Kereliuk provided me with a copy<sup>34</sup> of the Senate report and other archival material. The record indicates that the PDF association had been carrying out a variety of surveys and activities at least since early 1975. In connection with their first 2-year PDF appointment the two leaders of the PDF Association,

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<sup>34</sup> *The Post Doctoral Fellow in Chemistry, The Senate, April, 1976.*

both failed to publish results of research. I presume that on their arrival here they had focused on employment problems of PDFs and not on an enhancement of their technical and scientific reputations.

Currently the members of department have 48 individuals on PDF appointments. More than three-quarters are foreign. Since the 1976 Senate meeting an estimated 500 to 600 PDFs have been in the department. I am sure that mutual benefits have accrued to both the PDFs and chemistry staff<sup>25</sup>.

## 4.7 NATIONAL AND OTHER

The Canadian Council of University Chemistry Chairmen met annually at the CIC National Conference. It was important for me to be a part of that national body - to both contribute to it and learn from it. As Chairman of one of the big three chemistry departments (Toronto, UBC, and U. of A.) I was warmly welcomed and immediately put on the central committee for the second year. In my third year I was made Chairman of the group. During the term as Chairman at one meeting I gave a talk on the study I had made of the relation of teaching and research to each other and as summarized in Section 4.5.

The unwritten practice in the national committee was that the term of the Chairman was for one year. McDowell of UBC had been a regular attendant and had not yet been asked to be Chairman. When I was completing my year, on behalf of the Committee I asked him if he would take the

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<sup>25</sup> I have wondered if the PDF-Senate affair arose because some PDFs thought they might take advantage of weakness or uncertainty accompanying the appointment of a new Chairman.



position for the next year. He obviously wanted to be asked. However, he then held on to it for two years!

The collection and assembly of documentation for nomination of outstanding staff members for national awards was a major time consuming activity for me. There was no group in the Department that I could call on to look after that kind of important responsibility. I was also asked to assist in nominations of worthy persons outside of this university. One project was with respect to the nomination of Dr. Doug Ryan of Dalhousie University for Fellowship in the Royal Society of Canada. The nomination was successful in the sense that he was offered the Fellowship but it was a wasted effort on my part. He rejected the honor and that was a disappointment to me.

With the help and advice of Bob Crawford I started to organize teaching workshops. I thought I had to obtain financing from outside the department. I approached the Provincial Department of Education without success. I was able to obtain several thousand dollars from the Muttart Foundation and along with private donations the workshops were held. The teaching workshops have been continued as deemed desirable and the Department has renamed them the W.E. Harris Workshops. They have mainly been organized for staff in the Western Colleges and Universities, although the one in Guelph in 1995 had attendees mainly from central Canada. The most recent teaching workshop was here in 2003 with a focus on teaching general Chemistry.

During my term as chairman, it was a privilege to represent the Department in and outside of the University. I was gratified that the research momentum of the Department resumed its upward trend. I cannot overstate my appreciation for the high level of cooperation I received. I was now anxious to move on and complete the book writing project with Ron Kratochvil and to turn over the Chairmanship to a successor.

#### **4.8 CHAIRMEN AFTER 1979**

Those who have carried on with the development of the Department are: Robert Crawford 1979 - 1984, Robert Jordan 1984 - 1989, 1994 - 1996, Byron Kratochvil 1989 - 1994, Gary Horlick 1996 - 2001, and most recently Martin Cowie beginning in 2001. I asked each of them to compose a summary statement that gives the highlights of departmental matters during their time as Chairman. Their submissions bring the history of the Department up to date. I deeply appreciate their crucial additions to the History/Memoir. There has been an almost complete turnover of staff in the last three decades.

#### **DR. R. J. CRAWFORD**

It was May 1979 when Ken Newbound, the Dean of Science, asked me to serve for a year as the Acting Chairman of the Department. Walter Harris was stepping down and the Department wanted to go outside for a new Chairperson. At that time I was sitting as a faculty elected representative

on the Board of Governors of the University. This was not considered a conflict of any sort and so I agreed to give it a go. I stepped in to an office that had a clean desk, and only current matters to be attended to. Characteristically Walter had left the house in the best order possible. He briefed me on all of the matters pending and said that he would be available if I wanted to consult him on any issues. Later in the year I was asked to fill the job on a regular basis for the next five years. I had found it interesting and was flattered to be asked and thus agreed to continue until June 30, 1984.



R. I. Crawford, Chairman  
1979 - 1984.

#### Staffing in the Early 80's

In the spring of '81 Ray Lemieux, Bill Ayer and others of the Organic Division related that John Siddall of Zoecon Inc. was interested in joining our staff. Siddall had made a name for himself carrying out intricate work in the then emerging field of insect-pheromone chemistry. The University had instituted a rigorous position control policy and the rampant inflation of the early '80's meant that adding a new faculty member was almost impossible. Nevertheless we were able to argue, primarily on the grounds that our earlier loss of Satoru Masamune to MIT, that we had a need to establish a presence in an interdisciplinary-area (the buzz-word of the day). Siddall accepted our offer and was poised to come when he unfortunately contracted leukemia and passed away.

During the period that I was chairman we had three very significant retirements. The first of which was Walter Harris in '80, but he immediately swung into post-retirement endeavours by taking on the Chairmanship of PACCR (the President's Advisory Committee on Campus Reviews). He has never really not been around. This was followed by the retirement of Harry Gunning and Stuart Davis in '82. Harry of course was our champion and leader for many years as noted elsewhere in this treatise.

Stuart Davis had started in 1942 and served for 40 years. He was best known as the Associate Chairman from 1959 to 1982. In that role he took on many duties, liaison with other departments and Faculties about courses and timetables, the registration and advising of graduate students both before their arrival and on a year to year basis, the preparation of the Chemistry section of the University's calendar and as secretary at departmental meetings, which of course were held two or three times a year. Stuart was always kindly with the students and generally agreeable with his colleagues, he served diligently and asked little of others. When he left there was a huge void and no one else in the Department was willing to take on the job. This certainly made my task as Chairman more difficult and many of the duties had to be transferred to the support staff.



S. G. Davis (From page 1, of 1979 Chemistry bulletin)

Stanley Pons arrived on my watch and left on my watch so I guess that I should make a comment. An undergraduate at Wake Forest he moved on to graduate work at Michigan, only to quit to take over the management of the family textile firm in South Carolina when his father passed away. But he really wanted to be an electrochemist, so after a few years out he returned to graduate work at the University of Southampton in the U.K. He obtained his Ph. D. with Alan Bewick doing some FTIR on the surface of electrodes. Upon graduation he spent a year teaching at Oakland University in Michigan, and was eager to get into a research environment where he could "get ahead fast". He was playing "catch up" as a result of his somewhat delayed career. He was very eager to be promoted and frequently told me "All of my buddies my age are full professors by now Bob." He was prolific in publishing in a variety of electrochemical journals. When we did not move him ahead as rapidly as he wanted he decided to look elsewhere. Dallas Rabenstein, the then Chairman of the Analytical Division, insisted that we should make an attempt to keep Stan, even after we knew about the Utah offer. I did so, and an attempt was made to retain him. He felt it was inadequate, but some of us thought that it was the best he could expect. When he and Martin Fleischmann announced cold fusion four years later they generated one of the scientific controversies of the 20<sup>th</sup> century. There are indications that intellectual property considerations and an overly enthusiastic Vice President at Utah had caused them to announce their discoveries early, before publication, and well before any possible verification. In a sense we had lucked out.

Don McKenzie, who was our first Administrative Professional Officer, told me in early '84 that he would retire in the summer after 25 years of service. Anyone who knows Don would tell you that he had been a key to our having a great support staff, and he was a magician with the finances. Don knew all nooks and crannies of the budget and our trust accounts thus he was very helpful to all of our researchers. All of the support staff reported through him, and we were confident that we had the best support staff on campus. Don also had all the right contacts with Physical Plant, Personnel, Accounting and all of the support groups. He made each faculty member feel important and replacing him seemed like an impossible task. Fortunately my successor, Bob Jordan, had already been identified and so Bob headed up the committee to choose Don's successor. Luckily Arnold Adam and Tom Brisbane have brought similar charm and optimism to the position.



Don J. McKenzie (From page 26 of 1979 Chemistry budget)

### The PACC Review

During the '80's each administrative unit, academic and non-academic, was to undergo a review. The first part of this was a "Self Study Report". We gathered information about the Department's health in research and teaching and then had a retreat so that each Faculty member would have some say in the whole event. I was up to my ears in current administrative duties, and so asked Fraser Birss to read the

introduction that I had put together but that I was very unhappy with Fraser redid the piece and wrote the following section.

#### Departmental Orientation and Objectives

This is a teaching and research department. The great majority of its members judge themselves and their colleagues on the basis of the quality of their teaching and research. They are willing to forgive those members who slough off administrative duties provided those same members display a high level of competence in teaching and research. Of the two areas, research is rated more highly but not excessively so. There is a tradition for striving for good teaching, which adequately balances the esteem for research attainments.

This orientation of the department is, to some extent, at variance with the University's categories for judging performance of a faculty member

- Teaching, knowledge of the discipline and specialization,
- Research and scholarly work,
- Professional conduct, contribution to the department,
- Faculty and the University e.g. committee work,
- Public service and contribution to academic and professional bodies

Members do contribute in the latter two categories but, although they are respected for it, they are not expected to do it. They are expected to ensure that such work does not replace the performance of quality teaching and research.

The fundamental objectives of the Department out of this orientation, to excel at both teaching and research and to encourage each individual member to strive for excellence in both



J. W. Birss (From page 8 of 1978 Chemistry Bulletin)

These fundamentals have certain consequences. We have no 'research' or no 'teaching' faculty members. Although the size of the research groups are given some recognition in teaching loads, the basic premise is that everyone shall contribute equally to course instruction. This attitude extends to the staffing of lectures. It is assumed that lectures shall be given by full time staff members engaged in research. Departures from this premise have been made only when extraordinary staffing problems have arisen. Even the part-time lecturer has always held a doctorate in chemistry.

No one disputed Fraser's characterization of the Department and this orientation persisted through the '80's and 90's.

#### Inflation in the 80's

It is difficult for me to write about my time as Chairman and not talk about the effect of inflation, and the continuing budgetary constraints. In September of 1980 Brian Dunford applied to NRC for an equipment grant. The item in question was only manufactured in Japan. He was notified in April of its approval and by the time a new quote received the increase in the value of the Japanese Yen and the inflation within Canada made it such that we had to find essentially the same amount of money locally. Inflation was rampant, and even more so in the chemical sector since energy plays a large role in its costs. This resulted in the Canadian Council of University Chemistry Chairpersons (CCUCC) setting up its own cost index. It did not help that in 1981 Nelson Bunker Hunt tried to corner the silver market and the price of silver nitrate more than tripled in less than a year.



The aforementioned PACCR Self Study Report yields some data that illustrated the realities of budgeting in the eighties. Table 6.2 on Page 87 of the report clearly demonstrates that the purchasing power of our Supplies and Sundry account was reduced to a quarter of its original value when used to purchase chemicals.

**The effect of inflation on chemistry supply budgets**

<i>Year</i>	<i>Nominal \$</i>	<i>Budget in 1971 \$</i>	<i>CCUCC * Index \$</i>
1970-71	769,390	780,000	
1971-2	663,800	663,800	663,800
1974-5	531,780	422,047	422,047
1976-77	625,090	416,726	328,994
1978-79	594,440	332,089	240,663
1981-82	662,913	269,040	168,860

\* CCUCC - Canadian Council of University Chemistry Chairpersons

One might think that being on the Finance Committee of the Board of Governors would have been of help. But all too often I found that I was part of the group rendering the budget reductions, and that my ability to make a case with the Dean of Science using the data in the Table was severely compromised by the Board's cuts. The supplies and sundry budgets continue to be a problem, and probably always will for chemists, and no one can guarantee that there will not be another round of inflation. There were plusses to being on the inside of pending issues. I recall that the Finance Committee was considering changing the lower limit on capital to \$1000 from \$500. It was to be done by an incremental across the campus to all units method. A quick look at our purchases revealed that we had lots of items, balances etc. that fell into the minor equipment category that

was about to become supplies and sundries. Fortunately intervention meant that favourable adjustments were made.

Only four of us from the pre-Gunning era lasted more than five years into the Gunning era. I was the youngest and really only had one year, but what a contrast. So I asked the Editor WEH if I could add my bit. What follows are forty five year old memories may be coloured by my cynicism about "*the good old days*".

### My Pre-Gunning Year

Christmas 1955 was a very special one for me. I returned from graduate work at the University of Illinois for a very special reason, and I had time to visit my alma mater and to see the Faculty members. I learned two important facts. The first was that Prof O. J. Walker was to retire in 1956 and there would be a search for a new Head. The second was that there was to be an opening for an organic chemist, and I was invited to apply. I had obtained a Masters degree a few years earlier and so I knew that there was a real opportunity for change. The University's enrolment seemed to be stabilizing after the post-war increases brought about the Government of Canada's Veteran's Educational Programme. In fact it looked like the University might even hook on to the boom that was hitting the Province and begin to share in the downstream benefits of the 1947 discovery of oil at Leduc. I saw new bridges and roadways, refineries, shopping centres and apartment developments. My friends spoke enthusiastically about all of the developments and everyone seemed to be prospering. The professional football team, the three year old Eskimos,

had won the Grey Cup for the first time. There was a "Why not here?" attitude and so I applied. But my prime reason to return took me to Calgary where I proposed to Joan Fisher...and to my everlasting pleasure she accepted!!

My return to Illinois saw me working night and day to get my experiments done and thesis written. Besides I had no money to do anything else, it was still the hey day of the garret-room philosophy that students should be kept barefoot and broke. I had to borrow money from the University to get back to Alberta, as singles did not qualify for a removal allowance.

September came and along with it a 32 hour/week teaching load. Two sections of the first organic course +labs, the qualitative organic analysis course and lab, a half term course in analytical chemistry for chemical engineers. I worked my butt off and for less money than my younger brother was getting straight out of high school. But in October Thanksgiving week rolled around and I went down to Calgary and got married. She was brave too! Joan worked as a substitute teacher for the Edmonton Public Schools and so each night meant preparing lessons for both of us.

In addition to my teaching responsibilities, I was assigned to the New Building Committee by the Head of the Department. There were only six of us then and so everyone had to do something. Being junior, I seemed to have drawn the short straw. At the first meeting I met with Don Scott of Physics and Max Wyman of the Mathematics Department,

both were full professors and I felt more than a little overwhelmed. I learned that President Andrew Stewart and the Board of Governors had decided that there would be a new Science Building of 100,000 square feet to be shared by the three Departments, and weren't we lucky Chemistry was assigned 50,000 square feet. I had absolutely no idea what the size of our apartment was let alone the lab, and didn't squaring numbers make them pretty big pretty fast? So Bill Wallace, an inorganic chemist, and I went to the Campus Planning Officer, Jerry Sadler, and asked for the blueprints of the Medical Building that we were in at the time. Lo and behold we already had 46,000 sq. ft. We soon learned that the planners were talking gross areas and I was measuring net. We were in for a real set back.

I related these matters to my colleagues, and we decided that the building should be designed for how many students would be present in 1966. ten years down the pike. We got the demographic data from the Provincial Department of Education, and using conservative criteria, no increase in the participation rate and no increase from immigration we could predict that the then current Grade 2 classes would swell our student numbers to 16,000 from the 1956 number of 3500. Ouch. What had I got myself in for? But the rest of the Province was booming and the problems seemed to be located right at home on campus.

My colleagues, in particular Bill Wallace and Walter Harris, encouraged me to speak up at the next meeting of our Building Committee, but I was thinking about looking for a new job. At the next meeting, held in the Physics

Department, at that time located in the basement of the Arts Building, it was decided that we should tell President Stewart about the inadequacies of the plan. The three things that I remember coming out of that meeting was that Stewart, a former Director in the School of Commerce, told us that the U of A. would remain an Undergraduate University and would not grow beyond 6,000 students, and the University of Alberta at Calgary would remain a satellite campus. He told us that in his experience as an economist he knew that you could not plan beyond five years. Mr. Stewart did not have graduate training and taught courses involving crop economics and cycles. So I suspect that what he said reflected his experience. He was a charming and gentle Scot, who was well liked by all.

On another front Walter Harris was sitting on a committee to appoint a new Head for the Department, and we were supporting him in his efforts to get an outsider. I understand that Stewart was hesitant about that too. We got lucky. The President was called to Ottawa to head up a Royal Commission on the Regulation of Radio and Television Broadcasting, a task that led to his being named the first Chairman of the Board of Broadcast Governors. Dr. Walter Johns the Dean of Arts and Science was named Acting President (later to be appointed President). Somewhere in the administrative milieu, some rational people took over and the Government of Alberta's Department of Public Works took on the architectural planning process. I suspect that Johns, and Wyman got ten-year planning horizons and by February we had approval for Chemistry West, Physics and the V Wing. The

Department of Chemistry getting some 160,000 sq ft (14,700 sq m). My job application plans started to fade. Walter went off to the Spring ACS meeting in Miami and we hit the jackpot. We got Harry Gunning to come and show us how "to dream the chemical dream", and I'm still here too.

R. J. Crawford

## DR. R. B. JORDAN

My memories of this period are particularly vague, no doubt due to some deep psychological repression. The keyword of the time was survival in the face of continued budget cuts. Defending the Department against these steady financial onslaughts, and making painful cuts in staff and services, was a regular preoccupation. The main weapons in the battle were the outstanding local, national and international reputation of the Department, and the wise advice of former Chairs, including Harry Gunning, senior staff, and the invaluable assistance of Don MacKenzie. One trauma was the retirement of Don during this period, but the administrative transition to Arnold Adam proved to be smooth and the astute financial manipulations continued.



R.B. Jordan, Chairman 1984-1989 (Department Photo)

In retrospect, one can see that the financial restrictions started the research focus onto the more entrepreneurial

basis that has continued ever since. Research contracts became a source of revenue both for researchers and the Department. The Office of Research Services was a persistent thorn in the side, and its successors kept up this tradition for many years.

The chairmanship always brings some new and unexpected experiences. One that remains memorable is my one and I hope only appearance in Court as part of a case brought against a staff member, the Department, the Chair and the University. There was regular turmoil over an issue that might be diplomatically classed as the conflict between freedom of speech and its impact on the image of the Department. Again the Department's reputation was too strong to succumb to issues peripheral to chemistry. These are all learning experiences, and one that was particularly useful was my involvement on the Administration side in staff salary and benefits negotiations. Watching skilled negotiators such as Peter Meekison, Roger Smith and Brian MacDonald at work was enlightening and also painful as they justified keeping down the salary and benefits of myself and my colleagues.

As a final warning to future chairs, I must point out that it is a position that can stay with you for many years. Once stamped as an "administrator", the University seems to find endless uses for your services and a well honed ability to say "no" is the only defense.

R. B. Jordan

## DR. B. KRATOCHVIL

In the fall of 1988, as the end of Bob Jordan's term as chairman approached, the Department initiated the regular process of setting up a committee to identify candidates for the position. The conditions within the University were changing in the late eighties. Increasing research costs and student numbers, coupled with decreasing provincial support for Universities, were generating significant pressures on department budgets. Therefore it was not surprising that Bob was amenable to having someone else to deal with the situation for a while. When, as the selection process proceeded, I was invited to take the job, I agreed because I was approaching mandatory retirement age within the University, and it seemed appropriate to try to make a contribution to a Department that had been so supportive for many years. But having justified concerns about my lack of knowledge of departmental finances and personnel management, before accepting I asked Arnold Adam, the Administrative and Professional Officer who kept the department running, whether he was willing to continue to oversee these areas. He said he was, if he hadn't planned to stay I had decided not to accept the position.



B. Kratochvil, Chairman  
1989 - 1994

Another important part of the management team was that of Associate Chair, a position that included time-



consuming but critical tasks such as undergraduate advising, course scheduling, and related activities. Ted McClung has been carrying out this job most ably but felt, accurately, that he had contributed his share. None of the faculty I approached was interested, so I asked Margaret-Ann Armour, the Faculty Service Officer in charge of the organic chemistry teaching laboratories, whether she would consider it. Margaret-Ann had been supervising the organic laboratories with great success for a number of years. What convinced me to approach her was the level of energy and initiative that she brought not only to her FSO job but also to many other professional activities. (The list included participation in the affairs of the Canadian Society for Chemistry, conducting an active research program in chemical waste handling and disposal that attracted major external funding, and a deep commitment to the encouragement of women into science through the WISERST organization.) Margaret-Ann accepted the Associate Chair position, and she turned out to be an outstanding liaison and enthusiastic ambassador for the Department across the university and beyond. Her outreach in schools, and her expertise in chemical waste treatment and disposal, made her the most recognized faculty chemist in the community. Having Arnold and Margaret-Ann as co-workers made the majority of the departmental day to day operations go so smoothly I hardly had to think about them.

Right from the start Arnold and I had to deal with further budget cuts. The largest departmental budget components comprised personnel (academic and nonacademic) and chemicals/supplies, and the problem was

how to minimize the impact of cuts on teaching and research quality. In the end we elected to defer replacement of academic vacancies, to retain as many support staff as possible, and to retain as much of the chemicals/supplies budget as possible. The Dean (Dick Peter at the time) felt it would be better to reduce support staff and the chemicals/supplies budget. I thought that when times became better it would be easier to recover academic positions on the basis of teaching load than it would be to replace non-academic positions or increase the chemicals/supplies budget. In the event he went along with the department's plan. And, as we had hoped, within a couple of years we were able to begin replacing academic staff on the basis of our high teaching loads relative to other departments in the faculty.

Despite this strategy the cuts were severe enough that some reductions in the supplies and equipment budgets had to be done. At one point Hubert Hofmann, head of the machine shop, came to me with a problem. The shop's ability to build complex instrument parts needed by several research groups was severely constrained by the lack of a CAD/CAM milling machine. I quickly learned that such systems were not cheap. [The machine Hubert had his eye on cost over \$200,000.] Having exhausted the normal avenues of assistance within the university, I approached Harry Gunning for advice. He said he would think about it and get back to me. A couple of weeks later he called and asked me to come see him. I did. He told me he would personally contribute \$10,000 toward purchase of the system, and furthermore had talked with Frances Winspear,

who agreed to contribute another \$100,000. With this funding in hand Arnold was able to round up the rest, and before long Hubert and the shop had quickly learned how to use the new system and were creating beautiful precision-machined components. My only regret was that we were unable to arrange an event in the shop to recognize Frances and Harry before Frances died.

Faculty replacement became a major issue early on. The hiring boom of the early Gunning era was now resulting in many retirements, which had been made mandatory at 65. The list became longer as the term progressed: Otto Strausz in 1989; Shigeru Huzinaga in 1991; Paul Kebarle in 1992; Bill Ayer, Bob Crawford and Serafin Fraga in 1994; and Gordon Freeman, Bill Graham, Al Kalantar and Dennis Tanner in 1995. Early in the term a decision was made to look at the overall directions in which research in chemistry was evolving, and to try to hire faculty replacements that reflected these directions. This meant that in some cases replacements might not be within the same research area, and so the practice of departmental hiring committees consisting of 3 or 4 members from one division, plus one from another, was changed to one comprising the four elected divisional chairs plus the Department chair. Adjustment to the new arrangement was not easy, and many intense meetings ensued. But through this arrangement we were able to make new hires in biologically related areas such as bioanalytical and biophysical chemistry where important new breakthroughs were beginning to appear. One of the first faculty members hired in this way was Monica Paldic, who came in 1992 from the Department of

Food Science. Monica, the first female professor in the Chemistry Department, did not fit neatly into any of the four divisions of the day; she eventually elected to join the physical division. Other faculty hired during this time included Jeff Stryker in 1992; Steve Bergens, Dave Bundle and Glen Loppnow in 1993; Arthur Mar in 1994, and Wolfgang Yeager and Mark McDermott in 1995.

On completion of my five-year term in June 1994 I agreed to serve another, but requested a year of administrative leave to catch up on my research program, which had suffered from lack of time. During the leave year four students completed their research projects and theses, and several papers written. I returned to the Chair's office in July 1995, but that fall Martha Piper, Vice-President (Research), approached me again about the position of Associate VP (Research). Martha had contacted me about this job when she first took office three years earlier, but at that time I wanted to follow through on a number of initiatives we had started in the department and declined. Bill Bridger had accepted the position, but was leaving to become VP (Research) at the University of Western Ontario. After some reflection I agreed to take the job and moved to the VP office in January 1996. Bob Jordan, who has served as Chair while I was on leave, graciously agreed to take on the job again until the Department could select my replacement.

Department Chairs must often deal with unexpected events. Once during final exam time an anonymous phone call reported a bomb in the Chemistry building. Campus

Security was alerted, and the Head of Campus Security, the Vice-President (Physical Plant), and the Chair met in the Chair office. After discussion it was agreed by the three of us that the call was made by an unprepared student in an attempt to avoid a dreaded chemistry exam, and that the building would not be evacuated while Campus Security conducted a search. University Policy required those making such decisions to remain in the building until the search was completed and an all clear given. Notwithstanding our unanimous decision, there was a collective sigh of relief when the search failed to turn up anything. Later one of the Campus Security personnel commented that of all the buildings on campus, the Chemistry building was his least favorite place to conduct a bomb search.

Most chemistry chairs would agree that much of their time is spent dealing with people and space issues. To some chemists, laboratory research space is a symbol of research status, to be held on to as long as possible. Once, during a search for laboratory space for some of our newly hired faculty, a door to door survey was carried out to determine the number of student research spaces available to each of the current faculty members. This number was then compared with the number of active researchers in each research group, as reported by the faculty. Sometimes the lists included names of people who had graduated months before, or who would not be joining the group for a year. Other times we found space occupied by obsolete equipment unused for years but claimed to be essential for future use.

Probably the most public people issue I had to deal with during my term started as the result of an article written by Gordon Freeman that appeared in the *Canadian Journal of Physics*. The genesis of the article went back to a symposium on non-homogeneous kinetics organized by Gordon. The symposium, held at the Banff Centre, covered a range of topics in both experimental and theoretical physical science, and included speakers from several countries. Gordon asked the speakers to submit their presentations for publication; once collected he sent the set to the Senior Editor of the *Canadian Journal of Chemistry* (Bill Ayer at the time) with the request that it be produced as a symposium issue. Bill turned the submission down, apparently because he judged too many of the articles to be outside of chemistry. Gordon then submitted them to the *Canadian Journal of Physics*, but this time included an article he wrote arguing that mothers should not be allowed to work outside the home because of the harmful effects visited on the children. The papers, including the one by Gordon, were accepted by the journal and published. The appearance of Gordon's article raised a storm of protest across the country, and received international attention. Reporters phoned for comment, university faculty demanded that he be fired, and local radio talk shows were flooded with extreme opinions on both sides of the issue. The *Canadian Journal of Physics* came under heavy fire for publishing the article, and there were calls for, among other things, a review of the journal reviewing policy, a retraction of the article, excising of the article from every copy of that journal issue, and the Editor's head. Gordon enjoyed the publicity because it gave him an opportunity to give his

ideas a wider audience and because he loved the battle. He presented his arguments with skill and energy, and would continue as long as he had an audience. He delighted in bringing those who disagreed with him into a state of frustrated irritation, though I never saw him lose his temper. I learned quickly that whenever I had to talk with him it was better to go to his office so that I could leave when I felt the session was no longer productive, or when my temper became too short.

It seemed clear to me that notwithstanding the major blunder by the journal in accepting and printing an article not based on hard science, Gordon had a right to his personal opinions, and to express them in public. I took pains to point out that the opinions he expressed were not concerned with chemistry, and that he had as much right as anyone else to talk about them, so long as he kept them out of his chemistry teaching. Unfortunately he did not, and soon students were complaining about statements in lectures and questions on examinations that did not relate to the course material. After several warnings I eventually had to remove him from teaching until he agreed in writing to stick to chemistry only. Coming to agreement took a good deal of time and discussion but was eventually achieved; at one point Gordon complained to a senior university administrator complaining that I was bothering him "like a terrier nipping at the heels of a stallion".

Overall, the time spent as Chair, challenging though it was at times, was very rewarding. I learned a good deal about the people in the Department, and developed great

respect for the hard, unselfish work and dedication of the faculty and staff. It was an honor to be able to represent the Department within the University and externally

B Kratochvíl

## DR. G. HORLICK

Gary Horlick was appointed Chair of the Department of Chemistry in 1996. He had joined the Department in 1969 after his graduate studies at the University of Illinois. Horlick was a native of Western Canada, growing up in Saskatchewan and Alberta. Like Harris and Crawford, two other former Chairs, he received his undergraduate degree from the University of Alberta, which he attended from 1961 to 1965.



G. Horlick, Chairman 1996–2001 (Department Photo)

During the term of a Chair, there are always many changes and developments in the area of staffing. An era began in the last half of the 90s (1996–2001) in which there was considerable hiring activity. This hiring activity involved both renewal and expansion and concerned both the academic and support staff (non-academic) sectors of the Department. Junior staff added in that time frame included Dennis Hail (Organic Synthesis, Bioorganic and Combinatorial Chemistry), Rik Tykwinski (Organic and Materials Science), John Klassen



(Biophysical/Bioanalytical Chemistry), Lifang Sun (Analytical Chemistry), Pierre-Nicholas Roy (Physical Chemistry, Chemical Physics), Joel Haber (Inorganic materials Chemistry), and John-Bruce Green (Analytical Chemistry). In addition the Department was successful in recruiting and ultimately attracting three senior Faculty to the University of Alberta. Charles Lucy (Analytical Chemistry) joined us from the University of Calgary, Rod Wasylshen (Solid State NMR Spectroscopy) from Dalhousie University, and Fred West (Organic Chemistry) from the University of Utah. On the other hand, in the academic area some staff were lost. Lifang Sun decided to move on to San Diego State University, Neil Branda, a young staff member in the area of organic-molecular recognition chemistry, was recruited away by Simon Fraser University and Norm Dovichi (Analytical Chemistry) moved on to the University of Washington. Also, a number of academic staff joined the ranks of the retired including Fred Cantwell, Bruce Clarke, Ron Kratochvil, Hsung-Jang Lau, Bill Lown, Ted McClung, and Jim Plambeck. Thus, while there was considerable hiring activity, the overall level of the academic staff remained approximately constant. As a result, there was a growing and significant requirement to rely on sessional instructors to fulfill the teaching mandate of the Department. In part, because of this increased reliance on sessional instructors, a new type of appointment was instituted in the Faculty of Science, that of Faculty Lecturer. Faculty Lecturer was a full time teaching appointment and Christie McDermott was the first incumbent in this position for the Department.

Some key changes also occurred in the Faculty Service Officer (FSO) and Administrative Professional Officer (APO) ranks of the Department. Alan Hogg, the long term manager of the Department's Mass Spectrometry Laboratory, retired and Randy Whittall (a former student of Liang Li) was recruited as his replacement. A new FSO was added to the NMR laboratory (Albin Otter) with a focus on high field (600 MHz) bio-molecular NMR. Albin was subsequently chosen to head up the entire NMR facility of the Department with the retirement of Tom Nakashima in 2001. Finally, Arnold Adam, the Department APO was recruited away to serve in the Office of the Dean of Science and Tom Brisbane, recruited out of our NMR laboratory, took over as the Department of Chemistry APO.

Appointments, in form of "Chaired Positions" came to three professors in the Department. Professor Dave Bundle was the first incumbent named to the new R. U. Lemieux/Strathcona County Chair in Carbohydrate Chemistry, and both Rod Wasylishen and John Vederas were selected as Tier 1 Canada Research Chairs. In addition, Vederas had the distinction of being selected as a University Professor

After a period of cutbacks and attritions in the support staff sector in the late 1980s and early 1990s, the department was able to re-establish and expand critical support staff positions. In total, thanks to the Access Program, ten new full-time positions were established, several being conversions of soft funded positions to regular budgeted positions. These positions included laboratory

coordinators for analytical and inorganic chemistry, technicians for the mass spectrometry and X-ray service laboratories, new positions for computing and networking services, the machine shop and undergraduate stores and additional personnel for secretarial services, grant administration and bookkeeping. Finally a biological services laboratory was established, primarily for cell culture services, and a technician was hired to run this new facility.

There were many changes in the space infrastructure of the Department from 1996 to 2001. Renovation and renewal of the old Radiation Laboratory space in the sub-basement continued and resulted in excellent new space for several sectors of the Department. A large part of this area took on new life as the location of our high field (600 MHz) NMR laboratory and also provided expansion space for two more NMRs added to Department's NMR facility. The sub-basement also provided the space required for the Department's first Fourier Transform Ion Cyclotron Mass Spectrometer acquired by John Klassen for his research program. The extremely stable mechanical environment of the sub-basement also proved to be an ideal location for scanning probe microscopy. Both Mark McDermott and John-Bruce Green took advantage of this environment and located their scanning probe microscopes in the area. Finally, the sub-basement area continued to be the headquarters for the Computing and Networking Group, as the area providing a secure and isolated location for the Department network computers and servers. Also, after serving the Department for many years in several capacities including being responsible for the initial development of

the Computing and Networking group, Ron Gardner retired and Scott Delinger was assigned as the new manager of the group.

The Computing and Networking group also helped in the establishment of new facilities in the Department to support computer assisted teaching and computer controlled video projection of lectures. Through funding provided by the Infrastructure Renewal Envelope (IRE) a computer based (40 computers) teaching laboratory was established on the first floor of Chemistry West. In addition, IRE funding provided for conversion of our major lecture theatre (E1-60) into a multimedia classroom. In order to support the Faculty in their utilization of these rooms and in the development of digital and Web based lecture material, the Instructional Resource Center was also established. This center was staffed on an ongoing basis by a Department of Chemistry based Industrial Internship Student.

Some other changes that occurred in Chemistry West concerned the Glass Blowing Shops. The locations of the Department and the Technical Resource Group glass blowing shops were consolidated in renovated space in the basement of Chemistry West. The third floor space formerly occupied by the Department's Glass Blowing shop was extensively renovated and modernized into research laboratories for Charles Lucy when he joined the Department. This was the first comprehensive renovation of a research laboratory in Chemistry West and was an important renovation in that it provided a model and example of what could be achieved in modernizing

Chemistry West research laboratories. At about this time and after several years of requests and lobbying, some central funding for renovations of Chemistry West became available on a yearly basis. In this time frame, complete renovation of all undergraduate teaching laboratories on the first floor of Chemistry West was carried out. These laboratories serviced all the senior courses in inorganic, physical and organic chemistry. As the next decade began, Chemistry West became scheduled for more global renovations and improvements to its infrastructure. With these renovations, it should serve the Faculty and Students for many years to come. As well, at the turn of the century, a proposal was brought forward to rename the Chemistry Centre in honor of Professors Gunning and Lemieux. The Administration and the Board of Governors approved the change of name to the Gunning/Lemieux Chemistry Centre, thus recognizing two Professors who did much to develop the international research reputation of the Department and its strong presence on the Campus of the University of Alberta.

G. Horlick

### DR. M. COWIE

At the time of writing I have been Chair for only two and a half years, although at times it seems much longer. The reduced investment by the provincial government in post-secondary education that started during previous chairs' term has continued into my term, with no sign of respite. This has been manifest in continually increasing tuitions for students, and in my first year as Chair, an across-

the board cut of 5.4% in all budgets across the campus. As a result, the Chemistry Department lost six unfilled positions, threatening to put a temporary freeze on hiring. In spite of this, we have managed, with help from the Canada Research Chairs, and the University Faculty Award (UFA) programs, and by other means, to hire at a rate that is unprecedented in recent Departmental history. We have made eight new appointments in the last two years! In 2002 Jon Veinot, in Nanotechnology and Organic Optoelectronics, and Charles Wong, in Environmental Analytical Chemistry, joined the Department, while in 2003 Alexander Brown, in Theoretical and Computational Chemistry, Jillian Buriak, in Nanotechnology, Surfaces and Catalysis, Robert Campbell, in Bioorganic and Bioanalytical Chemistry, Hicham Fenniri, in Organic and Supramolecular Chemistry, Todd Lowary, in Carbohydrate Chemistry, and Yunjie Xu, in Physical Chemistry, became our newest colleagues. Jillian and Hicham are our first cross appointments with NRC's new National Institute for Nanotechnology currently under construction on our campus, and Yunjie is the Department's first UFA appointment. This overnight growth created significant challenges in accommodating everyone, but after a great deal of rearranging, all fit in rather well. During this period we unfortunately lost Ole Hindsgaul, who left to accept the prestigious Carlsberg Chair in Copenhagen, a position that comes with accommodation in the Carlsberg



M. COOKE, Current Chairman since 2001

mansion, formerly home to Neils Bohr, and with all the Carlsberg beer he can drink (How could he say "no" to such an offer?).

As noted earlier by Bob Crawford, "interdisciplinary" remains a buzz word in research, and consequently, plans are underway for the construction of the Centennial Centre for Interdisciplinary Science, to be constructed where the Physics building currently stands. This centre will house Physics and a number of interdisciplinary groups of which the Chemical Biology and New Materials and Nanoscience initiatives will have heavy involvement from Chemistry. The movement of as many as 10-15 research groups from Chemistry to this state-of-the-art research centre in about five years will do a great deal to alleviate the Department's space needs. However, in the meantime, space will remain a significant challenge. The University has finally acknowledged the complaints by previous Chairs and myself about the deteriorating condition of our West Wing and has initiated substantial renovations. The summer of 2003 was the last without air conditioning in this wing as a new air cooling system was installed before year end, together with significant cosmetic improvements to the building such as painting, new ceilings, new lighting, etc. This follows the renovations of the first-floor undergraduate laboratories that began during Gary Horlick's term. Next, we are to receive an improved air handling system to upgrade the fume-hood capacity in the building and we continue to lobby for much needed upgrades to the research laboratories, some of which has already happened.

It is always easy to look on the past as the "good old days", because in many ways they were. But our future seems brighter than ever and the Department has never been stronger, with substantial research strengths in a wide range of areas. Of course, it helps that several of our emeritus colleagues remain active on behalf of the Department, and I am deeply grateful for that support. Every team needs the aging veterans (they won't appreciate being labelled as such) to show the young guns how it's done, and this group continues to show us how. It is also difficult not to be in awe of the outstanding calibre of our new hires. There is no formula for hiring the best people for the Department, but somehow we seem to continue to get it right.

So how does the Chemistry Department stack up on campus and beyond? In this academic year alone we won five University awards (the J Gordin Kaplan Award, the Martha Cook Piper Award, the PetroCanada Young Innovator Award, the Faculty of Science Research Award and the Faculty of Science Award for Excellent Teaching), two Provincial awards, eight National awards and four International awards. In addition, the Carbohydrate Research Team of this Department, led by David Bundle, was awarded one of the first two Alberta Ingenuity Centres for Excellence. The tradition of excellence in this Department, started by the founding members, continues.

M. Cowie



## 5 CONCLUSION

### 5.1 ASPECTS OF THE DEPARTMENT

During the three decades up to 2001 the number of academic staff in chemistry decreased as a result of budget cuts. However, the number of publications per staff member has continued the upward trend established much earlier. In the following table it is to be noted that the number of academic staff dropped from 40 (Section 3.2) to 27.5. The number of publications has also decreased but by a smaller fraction.

*Academic Staff and Annual Publications Post Gunning*

<i>Period</i>	<i>#Staff</i>	<i>Pubs/yr</i>	<i>Pubs/Staff/yr</i>	<i>Comment</i>
1971 - 5	40.2	142.2	3.5	Last Gunning period
1976 - 80	39.4	148.6	3.8	Harris chairman, 1974
2001 - 2	27.5	127.0	4.6	Non Gunning staff

The following table shows that changes have been occurring among the four divisions in four sample years with respect to publication rates.

*Publications per Staff Member in the 4 Divisions*

	<i>Analytical</i>	<i>Inorganic</i>	<i>Organic</i>	<i>Physical</i>
1957	1.3	7.0	2.1	2.8
1975	2.0	6.0	3.5	3.4
1980	2.2	2.0	4.0	4.8
2002	5.7	3.1	5.7	2.6

### Nature of the Department in 2001

1. Most of the current staff have been appointed since the 1970's.
2. All of the staff in the upper tier (Section 3.2 under subheading "Research") have retired.
3. The number of academic staff in 2001 was about 2/3 of the maximum three decades earlier.
4. The favorable upward trend in the number of publications per staff member established during the Gunning era has continued. In 1975 the number of pages per publication was 7.3, in 1980 it was 9.1 pages suggesting a trend also to more substantial research.
5. A major change in the composition of the Department is that the number of physical chemists in 1971 was 16 and in 2001 it is 8.
6. The Department is now a balanced one among the four divisions, although not with respect to the number of graduate students.
7. There has been major shifts in the interests of the graduate students. The distribution of the 185 graduate students now favors the analytical and organic divisions. Before 1965 the number of graduate students in the analytical division had remained close to zero.

Staff, Students, Publications in 2001

	<i>Analytical</i>	<i>Inorganic</i>	<i>Organic</i>	<i>Physical</i>
# Staff	6	7	7	8
# Grad. Students	42	20	81	21
# Publications	34	22	40	21

8. For teaching purposes a number of annual sessional appointments have been made.
9. In contrast to 1980 there is now a pool of retired staff. Some of them carry out special assignments for the benefit of the Department, such as assembling nominations for honors and awards - or helping with this History/Memoir.

## 5.2 ACADEMIC STAFF

### Academic staff, 2003

<u>Name</u>	<u>Division</u>	<u>Appointed</u>	<u>PhD</u>
R. G. Cavell	Inorganic	1964	UBC
R. B. Jordan	Inorganic	1965	Chicago
G. Horlick	Analytical	1969	Illinois
G. Kotovych	Physical	1970	Manitoba
J. Takats	Inorganic	1971	MIT
D. L. Clive	Organic	1975	London
M. Cowie	Inorganic	1976	Alberta
J. C. Vederas	Organic	1977	MIT
O. Hindsgaul	Organic	1981	Alberta
D. J. Harrison	Analytical	1984	MIT
M. Klobukowski	Physical	1989	Poland
L. Li	Analytical	1989	Michigan
J. M. Stryker	Organic	1992	Columbia
S. H. Bergens	Inorganic	1993	Chicago
D. R. Bundle	Organic	1993	Newcastle, Adj. prof.
G. R. Loppnow	Physical	1993	UC Berkeley
A. Mar	Inorganic	1994	Northwestern
M. Palcic	Physical	1994	Alberta
W. Jaeger	Physical	1995	Kiel
M. McDermott	Analytical	1995	Ohio State

D. G. Hall	Organic	1997	Sherbrooke
R. R. Tykwinski	Organic	1997	Utah
J. S. Klassen	Physical	1998	Alberta
C. A. Lucy	Analytical	1999	Alberta
P. N. Roy	Physical	1999	Montreal
J. A. Haber	Inorganic	2000	Washington, MO
R. Wasylishen	Physical	2000	Manitoba
J. B. Green	Analytical	2001	Iowa
F. G. West	Organic	2002	Wisconsin
J. G.C. Veinot	Inorganic	2002	Western Ontario
C. S. Wong	Analytical	2002	Minnesota
X. C. Le	Analytical	2002	UBC, Adjunct prof.
J. A. Brown	Physical	2003	Western Ontario
R. Campbell	Organic	2003	UBC
T. L. Lowary	Organic	2003	Alberta
M. Buriak	Inorganic	2003	Louis Pasteur
H. Fenniri	Organic	2003	Louis Pasteur
Y. Xu	Physical	2003	UBC

### Academic Staff, Retired, 2003

#### Residing in Edmonton

<u>Name</u>	<u>Discipline</u>	<u>Appointed</u>	<u>Retired</u>	<u>PhD</u>
W.E. Harris	Analytical	1946	1980	Minnesota
S. G. Davis	Physical	1942	1982	McGill
O. P. Strausz	Physical	1963	1989	Alberta
S. Huzinaga	Physical	1968	1991	Kyoto
P. Kebarle	Physical	1958	1992	UNC
W.A. Ayer	Organic	1958	1994	UNB
R. J. Crawford	Organic	1956	1994	Illinois
S. Fraga	Physical	1963	1994	Madrid
G.R. Freeman	Physical	1958	1995	McGill

W. Graham	Inorganic	1962	1995	Harvard
A. H. Kalantar	Physical	1964	1995	Cornell
D.D. Tanner	Organic	1963	1995	Colorado
J. E. Bertie	Physical	1967	1996	London
K. R. Kopecky	Organic	1961	1996	UCLA
B. Kratochvil	Analytical	1967	1998	Iowa State
H. J. Liu	Organic	1971	1998	UNB
J.W. Lown,	Organic	1964	1998	London
J. S. Martin	Physical	1963	1999	Columbia
R.E. McClung	Physical	1969	1999	UC
J. A. Plambeck	Analytical	1965	2001	Illinois
F.F. Cantwell	Analytical	1975	2001	Iowa

Residing outside Edmonton.

W.F. Allen	Analytical	1956	1985	Toronto
H. B. Dunford	Physical	1957	1993	McGill
W. R. Thorson	Physical	1968	1994	Cal. Tech.

**Academic Staff, Deceased**

<u>Name</u>	<u>Division</u>	<u>Appointed</u>	<u>Deceased</u>	<u>PhD</u>
A. Lehman		1909	1930's	Liepzig
N. Stover	Inorganic	1919	1938	Illinois
J. W. Shipley	Physical	1930	1942	Harvard
E. H. Boomer	Physical	1926	1946	McGill
O. J. Walker	Analytical	1923	1959	McGill
D. Darwish	Organic	1958	1973	UCLA
R. K. Brown	Organic	1946	1974	McGill
F. Birss	Physical	1959	1987	Oxford
J. Hooz	Organic	1965	1989	Purdue
R. B. Sandin	Organic	1918	1991	Chicago
R. U. Lemieux	Organic	1961	2000	McGill
H. E. Gunning	Physical	1947	2002	Toronto

## 5.3 CURRENT DEPARTMENT

Dr Margaret-Ann Armour has had a special role in the Department as the Assistant Chairman from 1989. She is a role model particularly for women scientists. She is a founder of WISEST (Women in Scholarship, Engineering, Science, and Technology). She has numerous awards in recognition of her activities, including YWCA Tribute, Woman of the Year, Canada Medal, ASTech Award, McNeil Medal, 3M Teaching Award, Sarah Shorten Award, Governor General's Award, Kaplan Award, and featured in an article in Maclean's Magazine. The most recent information is that she will soon receive the prestigious American Chemical Society Award for Encouraging Women into Careers in the Chemical Sciences.



M. Armour (Canadian Chemical News, October 2003, Page 6)

The current Chemistry Department is highly regarded one of the big three in Canada along with UBC and U. Toronto. It is now a world class center for research and education in chemistry. Currently all academic staff members of the University of Alberta Chemistry Department receive major NSERC operating grants. The staff of the Department have long been receiving internal and external recognition and awards for their contributions to teaching, research, and public service.

Eminent staff that have been enticed away by other institutions include, S. Masamune to MIT, D. Rabenstein to U. California, M. Robins to Utah, N. Dovichi to U. Washington, O. Hindsgaul to the Carlsberg Chair, Denmark.

Three members have received the Order of Canada. The University of Alberta has awarded honorary doctorates to four members of the Chemistry Department. Externally, five different members have received honorary doctorates from other universities (R.U. Lemieux 15 of them) Three have been Presidents of the Chemical Institute of Canada (CIC), thirteen have been elected to Fellowship in the Royal Society of Canada, and three have been named Honorary Fellows of CIC.

In the remarkable last 8-year period 1996 - 2003, members of the Department have received 25 University awards, 8 Provincial Awards, and 40 National Awards. In addition there were 12 International Awards in the last 8 years, N. Branda, D. Clive, N. Dovichi, C. Lucy, D. Hall, J. Harrison (2x), G. Horlick (2x), O. Hindsgaul, J. Klassen, and P. Roy

Over the years many things have been done right and something great has been the result. It is not by accident that the current Department is where it is.

## Lectureships

Currently the members of the department invite distinguished visitors to come to the department to present talks, seminars, and thesis examinations and to interact with staff and students. A series of lectureships have been established and they are: AstraZeneca; Fraser W. Birss Memorial; Boehringer Ingelheim; Edward Herbert Boomer Memorial, Endowment Fund for the Future - Distinguished Visitor; Merck-Frosst; Harry Emmett Gunning; W E. Harris Teaching Workshops; R.U. Lemieux Lecture on Biotechnology; Reuben Benjamin Sandin; Xerox Lectureship. The invited visitors who have been the lecturers for memorial lecture series are given two pages hence. The Boomer series was started in 1959 and was shared by the analytical inorganic, organic and physical divisions. With the establishment of organic and physical lecture series, only the analytical and inorganic divisions now share the Boomer lectureships. The memorial lectures are listed two pages hence.

## Summary

In 1974 when a new chairman had to be appointed to succeed Dr. Gunning there was deep concern about the future. Nearly all the members of the Department had been appointed by Gunning and he had provided all with excellent conditions for carrying out their professional activities. During the changeover the sense of impending doom lasted for about three or four years. The strong staff continued to build on the sound foundation that had been laid in the department and favorable trends continued.



During the last three decades there have been five more changes of Chairmanship with negligible accompanying trauma of the type that followed Gunning's departure. In spite of budget slashing in the interval from 1974 to 2003 the Department has simply become better and better.

There has been a virtually complete turnover of academic staff in the last three decades. The Department has also changed in fundamental ways. The Physical division is no longer the dominant one. The Department is more balanced with about equal numbers of staff in each of the four divisions. There is imbalance in the numbers of graduate students among the divisions.

At an earlier time when I was involved with the PACCR reviews for the University we noted that some departments had gone through something akin to a life cycle. The cycle included initiation, a period of struggle to become established, a period of growth, a plateau period where things go well without noticeable growth, and then a period of decline. In the Chemistry Department some of such a life cycle has taken place in the Physical Division. The Analytical Division has gone through a period of struggle and more recently has had a time of unusual growth. Careful monitoring is important so that appropriate action can be taken to bring about a process of renewal when a period of decline or stagnation may be near

## Memorial Lecturers 1959 to 2003

## Boomer Memorial Lectures

1959 B.W. Steacie	1974 G. Herzberg	
1960 K.B. Wiberg	1975 T.L. Brown	1980 R.R. Schrock
1961 H.A. Laitinen	1976 M. Eigen	1990 J.W. Jorgenson
1962 F.S. Dainton	1977 W. Simon	1991 M.L.H. Green
1963 A.F. Wells	1978 K. Laidler	1992 R.W. Murray
1964 S. Hazinaaga	1979 E.L. Maerteries	1993 J. Barrow
1965 F.G.A. Stone	1980 R. Clementi	1994 S.A. Rice
1966 G.S. Hammond	1981 G. Catochon	1995 R.J. LeRoy
1967 H.S. Frank	1982 R. Marcus	1996 C. Fenselau
1968 P.A. Cotton	1983 R. Hoffman	1997 M.J. Hawthorne
1969 C.N. Ratley	1984 R.G. Cooke	1998 R.G. Bergman
1970 G.C. Pimentel	1985 J. Halpern	2000 R. Anbersold
1971 J. Lewis	1986 G.M. Hieffje	2001 G.S. Girolami
1972 A.D. Buckingham	1987 T.J. Marks	2002 C.A. Murkin
1973 H.V. Mahanstadt	1988 J.M. Harris	2003 T.E. Mallouk

## Sandia Memorial Lectures

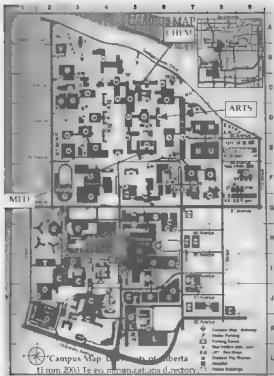
1962 S. Winstein	1976 B. Ljungberg	1990 D.J. Cram
1963 E.E. Van Tasselen	1977 Sir John Cornforth	1991 G.M. Whitesides
1964 C. Budé	1978 H.G. Khosara	1992 P.G. Schultz
1965 J.D. Roberts	1979 B.R. Bellows	1993 B.M. Trost
1966 A. Eschenmoser	1980 G. Stork	1995 Sir Jack Baldwin
1967 Sir Ewart Jones	1981 Y. Kishi	1996 R. Mayori
1968 H. Eggerer	1982 J.M. Lehn	1997 T. Mukaiyama
1969 Sir Derek Barton	1983 P. Deslongchamps	1998 C. Walsh
1970 V. Vogel	1984 K. Mislow	1999 S.V. Ley
1971 K. Witsener	1985 R.A. Raphael	2000 R.G. Grubbs
1972 D. Arlgoni	1986 C. Walling	2001 K.B. Sharpless
1973 R. Breslow	1987 J.R. Knowles	2002 P.B. Dervan
1974 G. Ourisson	1988 D.A. Evans	2003 P. Wender
1975 K. Nakatsuhi	1989 D. Seebach	

## Gunning Memorial Lectures

1983 M. Calvin	1993 H.B. Gray
1984 P.M. Rentzepis	1994 S.A. Rice
1985 K.S. Pitzer	1995 R.L. Saykally
1986 J.N. Pitts	1997 W.L. Jorgenson
1987 R.R. Ernst	1998 R.N. Zare
1988 W. Klemperer	1999 H. Kuroi
1989 A.H. Zewail	2000 R.M. Hochstrasser
1990 H.F. Schaefer III	2001 G. Scoles
1991 G.R. Fleming	2002 C.J. Jameson
1992 J. F. Holzwarth	2003 J.P. Klinman

## Birn Memorial Lectures

1989 R.F.W. Bader
1990 L.G. Connadua
1991 W.G. Laidlaw
1992 D.F. Weaver
1993 V.H. Smith
1994 R.J. LeRoy
1995 P.R. Bunker
1997 C. Patey
1998 R.E. Kapral
1999 L.E. Kay
2001 D.A. Ramsey



CHEM = Current Chemistry Headquarters

ARTS = Arts Building, Chemistry Headquarters 1915-1923

MED = Medical Building, Chemistry Headquarters 1923-1960

## **APPENDIX I – CHEMISTRY MEMOIR**

### **Personal Timeline WEH**

1932 - Complete Grade 10 at Nashville # 565 rural school  
1934 - Complete Grade 12, Wetaskowin H.S.  
1938 - BSc U Alberta, Honors chemistry  
1939 - MSc U Alberta, O.J. Walker, Distribution of Selenium  
1939 - Register at the U Minnesota, I. M. Kolthof  
1942 - Marry Phyllis Pangburn  
1944 - PhD Analytical chemistry Polarography of Uranium  
1944, 1947 - Children Margaret, Bill born.  
1943 - 6 Wartime research, synthetic rubber  
1946 - 1980 Academic staff member, U Alberta  
1946 - 57 Decade of major teaching responsibilities  
1957 - 8 Leave of absence, Atomic Energy of Canada  
1974 - 79 Chairman of the Department  
1977 - 4-month Visiting Invitational Professor, Arizona State U  
1978 - Granddaughters Glenna and Martha born  
1980 - Professor emeritus  
1980 - 92 Chairman of PACCR for the University President  
1992 - Phyllis deceased  
1997 - Travel, write

### **A - GRADUATE STUDIES, JOBS, AND WAR**

Thus section of the Appendix describes my journey through graduate studies in chemistry, jobs and the Great Depression, wartime responsibilities, and then a time of plenty of jobs. Before and during World War II graduate studies were indeed utterly different from what they became a couple of decades later. Currently, support for graduate studies continues to improve dramatically.

When I was an undergraduate, Sandin advised us students that if we intend to go for PhD studies "have

enough money to last one year and things will work out." That was good advice. For me it meant searching for paying jobs from which to save money for the one-year nestegg.

Contributing to the war effort was part of my life as a graduate student. After the war, getting a job was not really a problem but rather getting one that was right for me.

#### MSc Year 1938 - 9

During my fourth year in the Honors Chemistry program I decided I would attempt to complete graduate work. In the spring (1938) I applied without success to about a half dozen U.S. universities for a teaching assistantship. I also applied for the U. of A. Board of Governors scholarship of \$600 toward an MSc. For that scholarship I understood that I was second to Flora McCleod. I also heard that she was considering going to France for graduate studies. After graduation, I attempted to find a job for the summer. I had written innumerable letters to mining, food, water, and soil companies in Western Canada without success. The time was the Great Depression and jobs were certainly scarce. I applied in person to all likely places in Edmonton that might have a job - any job - "I will do anything". After a week at home (three miles S. of Gwynne, Alberta) planting a carragana hedge I hitched an overnight ride on a truck to Calgary. I spent a few days with an Aunt and Uncle (Mary and Clay Harns) and canvassed job possibilities in Calgary. Next I hitched a ride to Turner Valley where Alberta's first oil field was being explored.

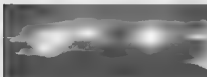
At Longview at the south end of Turner Valley I applied for work in-person to Denton Spencer, who was the foreman of a work crew for Anglo Canadian Oil. I quickly told him my credentials and said I wanted a job - any job. Laconically he said "Show up tomorrow morning." I then went to a boarding place and asked to be able to stay there and to pay later. I went to the only store in Longview and told the owner I have a job starting tomorrow morning and I need work clothes. I have no money but I will pay you as soon as I am paid. The owner declined to fill my request. I persisted and he finally relented.<sup>36</sup> I

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<sup>36</sup> On May 23, 1938 I obtained work shoes, \$6.75; overalls, \$2.75; socks, \$.39; cap, \$.98; shirt, \$1.69; gloves, \$1.65. Total owing \$13.81.

showed up for work the next morning with new clothes. I was told later that my new clothes did not give a good impression to the other workmen. It was a summer of largely physical labor from which I earned \$378.05 and saved \$198.

In the oilfield there was an appalling waste of natural gas—methane and other light hydrocarbons. This crucial non-renewable resource was simply burned. I took the following photograph in the middle of the night. On the left



Flares from burning of natural gas. Summer of 1938 (Flora MacCleod)



the panorama shows about a dozen flares and on the right is a close-up of one of them. That flare burned about ten million cubic feet every day and was much higher than a telephone pole. I learned later that at about this time Dr. Boomer of the Chemistry Department was playing an important role in the later formation of the Oil and Gas Conservation Board (Section 21). Another wasteful practice was to use the high pressure gas (up to 2000 pounds per square inch) to operate motors. The gas was not even burned in this instance.

At the end of the summer I returned home with the not well-focused intention of going somewhere for graduate studies. I phoned Dr. Mordon H. Long of the History Department of the University to ask about the status of the Board of Governors scholarship. He said he would find out and to call again tomorrow. I did and was told that it was open and I could have the \$600 scholarship for the coming year (1938-9). I don't know what Flora MacCleod did after graduation but it was great good fortune for me. I would now not have to call on my parents for financial assistance in pursuit of further education.

During the next eight months I worked towards an MSc with Dr Walker. I also gathered information about many U.S. and Canadian universities concerning graduate work in analytical chemistry. I examined the chemical literature and found that Dr. I. M. Kolthof stood out far above all others in the field. He was indeed the world's foremost analytical chemist. He was at the University of Minnesota so that is where I would try to go next year. Had I wished to do graduate studies in organic chemistry I probably could have obtained substantial help from Dr Sandin to go to the University of Illinois or Wisconsin. Had I wanted to continue in physical chemistry I could have gone to McGill University. However, since I was interested in analytical chemistry, the University of Minnesota was my target.

The Board of Governors \$600 scholarship was more than enough for my expenses for the year. I stayed in St. Stephen's College, and board and room there was my main expense. I saved about \$200 from the scholarship. In the spring I applied to the University of Minnesota for a teaching assistantship with no success. The next summer I worked again for Anglo Canadian Oil - this time with an office job and with a room in the field office building.

#### University of Minnesota and Dr. I. M. Kolthof

By the fall of 1939 I had saved about \$600 from the two summers and the scholarship. I left for Minnesota with my one-year bankroll and a student visa just as Hitler started World War II. I took an overnight train to Minneapolis by way of Portal N. Dakota. I don't remember but I must have carried my bankroll with me in cash. Wartime regulations including currency interdiction were not immediately in place that would have prevented me as well as my money from leaving Canada.

At the University of Minnesota I went to see Dr. Kolthof. He suggested two possible research projects - one involved the aging of precipitates and the other polarography of a then obscure little known element - uranium. I talked with some senior graduate students - mainly Carl Miller and Herb Laitinen. They advised me that polarography was the interesting new field and I chose the polarographic topic. Aging of precipitates was a yesterday's problem.

About a month after I arrived Dr. Harold Urey as an invited speaker gave a seminar to the Department. It was one of the memorable days of my life in that he had just received the Nobel Award. Back at the University of Alberta in the Journal Club I had given a presentation (Section 2.2) on a paper by Urey. Now I saw the great scientist in person.

With an analytical major and physical minor, I was required to take two years of courses in analytical chemistry (advanced analytical, potentiometry, microqualitative analysis, indicators, microquantitative analysis, polarizing microscope) and physical chemistry (thermodynamics and advanced physical). I also had to pass German and French exams, take written and oral prelims, graduate student seminars, and later carry out the experimental work and write a PhD thesis. As a new graduate student I obtained valued and welcomed advice and help from senior graduate students.



W. E. Harris, Student 1941

Dr. I. M. "Piet" Kolthof was born and educated in Holland. My understanding is that during his PhD and postdoctoral years he had no institutional or mentor financial assistance. From his PhD thesis he obtained 19 publications. Early in his career (October 1926), he became an academic staff member at the University of Minnesota. He soon became the Dean of analytical chemists in the world. He was a role model for scientists, had an exceedingly active mind with great intellectual power and published over 900 research articles and nine textbooks. He worked extremely hard and, yet later in life, he said "I could have accomplished much more if I had worked harder." When I joined his research group he had 15 graduate students under his direction. He ran an efficient hard-driven operation, could be a harsh reviewer and he described himself as a "hell-raiser." He was an outspoken defender of social justice. On the sports side he liked tennis. As a graduate student I was often called on to provide a fourth for



tenuous in the U.S. witch-hunting days of Senator Joseph McCarthy Kolthof was accused of belonging to 31 subversive organizations.

I learned that Kolthof normally spent the first hours of the day at his suite where he lived on campus, reading the chemical literature and thinking about the various research projects of his students. He made notes and suggestions for future work on little pieces of paper and came to his office in the Chemistry building at about 10:30. Usually he would then talk to his graduate students and learn about the status of their research. Graduate students could expect him to come a couple of times per week to discuss progress and drop off the notes he had made earlier in the day. Most of the suggestions would have taken a couple of weeks or months to work through and so the notes tended to pile up unattended. Senior graduate students could expect to talk with Kolthof with increasing frequency. His office door was open and at any time it was easy to consult him. It was an inspiring experience to work with an extraordinary intellect and to be part of his group of brilliant graduate students. Later, he initiated work on the synthetic rubber project - brand new to him and to us. He was highly dedicated to research. As a bachelor he didn't approve the distractions of courtship activities of young men (i.e. his grad students).



I. M. Kolthof (From *Analytical Chemistry*, 2nd, 287A (1969))

Kolthof had a total of 67 PhD graduate students many of whom entered academia. During his lifetime, that is by 1993, Kolthof's academic descendants with PhD degrees was up to a total of 1500. Kolthof and his academic descendants gave shape to much of modern analytical chemistry. Many of his graduate students came from foreign countries. After graduation many returned home (such as Italy, Japan) where they often played a leadership role in analytical chemistry in their home country.

### Selective Service and Certified Instructor

With the intensifying war in Europe, I was required to register for the Selective Service System of the U.S. Armed Forces. My registration was in Hennepin County and my Order Number was 2206.

As a foreign student (alien), I had to report my address every 3 months to Washington D.C. To do so I had to go to the post office every three months to obtain the card to mail to Washington. My 3-monthly visits to the Post Office were unpleasant in that I received reluctant service. I was made to feel unwelcome - kind service to aliens was not obtainable.

The bombing of Pearl Harbor by the Japanese was on the Sunday morning December 7, 1941 (I listened on the radio in my lab as it was happening). The U.S. then entered the war as a combatant. After the bombing there was fear that the continental U.S.

might be attacked by Japan. We should be prepared. Early in 1942 the Department added an extra requirement. Chemistry graduate students had to become certified instructors in gas and bomb defense.

In late 1942, to end the war effort, Kolthof asked me to interrupt my thesis research and undertake war research on synthetic rubber under his direction.

### Money Management (or Game Over)

I wanted the financial support of, but did not have, a teaching assistantship. It was the time of the Great Depression and there were few

assistantships available. Some other graduate students, such as Leo Safranaka, told me that I should understand that as a foreigner I would have low priority for any opening. I soon found that without a teaching assistantship I also had little standing. Because I had no financial support from the Department I could not obtain supplies from the Chemistry Stores. To carry out a polarographic study I therefore needed to construct a manual polarograph. With the advice of other graduate students I bought switches and rheostats from Radio Shack to assemble a polarograph<sup>37</sup>. For the assembly I recall I needed a meter or so of thin coated copper wire - a couple of pennies worth. The Storeroom turned me down flat. Mindless rules impeded progress. I noticed that a couple of other beginning graduate students in situations similar to mine simply quit. Koithof had 15 graduate students, probably did not really want more, and did not need to meet my needs for supplies.

I realized my one-year pot of money was getting used up. The tuition fee for the year was \$105. My room rent was \$25/month. I had to buy some books and the polarograph assembly materials. I bought, unnecessary but important, season tickets to 18 concerts of the Minneapolis Symphony at the Northrup Auditorium on campus. Food was inexpensive but still there was a cost. One day I stopped at a cafeteria and was enticed to buy a meal ticket for \$14 to cover the next dozen or so future meals. I had an excellent meal but the next day the place closed and never opened again. In relative terms it was the most expensive meal of my life.

I couldn't splurge but I was living a good and exciting life. I had full social recreation activities. I had met and had frequent dates with Phyllis. My recollection is that I wasn't worried or concerned about money. However, with some urgency, I realized I must manage to stretch my remaining money. Because of war restrictions, none could come from my parents in Canada even if I wanted to deviate from a path of independence.

The first little help came when a notice was posted by Dr. D. E. Hull in 1939 inviting someone to become a radon collector. I obtained

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<sup>37</sup> When I returned to Alberta I brought my control box with me. Dr. Kratochvil has the archival item.

that job which gave me about \$10/month. It involved the collection of radon at intervals of two or three weeks from one gram of radium that had been obtained by Dr. Lind from Madame Curie. Originally it took about 400 tons of uranium ore to obtain the single gram of radium and it was worth more than the rarest gems - about \$180,000. The equipment for radon collection was in a tiny unventilated room in the basement. At crucial steps in the two to three hour collection procedure, I needed to turn off the light to see where the radon was. When I did so the entire glass apparatus became visible from the radiation. The rule of the department was that for safety reasons a graduate student should not be the radon collector for more than one year. However, I did it for two years.

I have no doubt whatsoever that I was heavily overexposed in terms of present day radiation regulations<sup>38</sup>. I am a non-smoker and the most reliable evidence<sup>39</sup> indicates that periodic moderate (over) exposures have a positive effect (hormesis) on the health of a nonsmoker. After I married I was concerned about the effect my high radioactivity exposures would have on my children. Both they and my grandchildren are normal.

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<sup>38</sup> Regulatory agencies use linear no threshold extrapolations to estimate risks at low doses. The resulting estimates are high by absurd amounts. The relation between dose and risk response is sigmoid or of S-shape in accordance with the normal bell shaped distribution. To soundly extrapolate risks at low doses from risk information at high doses use probability graph paper. R.J. Tallardia, and L.S. Jacob: "The Dose-Response Relation in Pharmacology", p.106, Springer, New York, 1979. R.R. Sokal and F.J. Rolf, "Biometry", Chapter 14, W.H. Freeman, New York, 1981. W.E. Harris, *Low-Dose Risk Assessment*, the Internet.

<sup>39</sup> S. Kondo, *Health Effects of Low-Level Radiation*, Kinki U. Press, Osaka, Japan, 1993. Medical Physics Publishing, Madison, Wisconsin. J.P. Young and R.S. Yalow, Eds, *Radiation and Public Perception*, American Chemical Society, Advances in Chemistry Series #243, Washington, D.C. 1995. *Health Physics*, 52 May(1987).

Today the radium is a problem for the University of Minnesota. The room is now sealed and no entrance is permitted. The radium is now a real long term dilemma for the Department - a liability

Another source of help came particularly from Carl Miller. With his advice I bought a small frying pan, and supplies such as canned beans. I then cooked and ate in my lab for about \$10/month. I gave up my nice room. I moved to a mattress on a storage attic floor, a sleeping-only arrangement for \$10/month.

The next fall another graduate student Ken Stevenson and I helped with breakfast at a dormitory for which we obtained three great meals per day

Finally, a just-in-time solution. Sometime during the winter quarter of my second year (1941) I was at a party and Phyllis Brewster (organic chemistry grad student and of the Banff Brewster family) told me that she was quitting and her inorganic teaching assistantship would be open. The first thing the next morning I went to see Kolthof and told him that a teaching assistantship would be available in the third quarter and "I want it!" He phoned Dr Sneed of the Inorganic Division who, not yet knowing the situation, denied that my information was correct. I did obtain the \$55/month assistantship at a time when few resources remained<sup>40</sup> That teaching assistantship meant my financial problems were solved for the foreseeable future. I now also had some rights at Chemical Stores!

### Teaching Assistant

My first T.A. was for Dr. L. Cohen in freshman chemistry. Her class had many behemoth-type football players. Decorum was important for her. As a T.A., I must never so much as lean on a bench. I most remember the endless amounts of marking of turn-in assignments. The next summer and for the fall quarter I was a T.A. for Dr. C.B. Heisig,

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<sup>40</sup> The times have certainly changed even after making an allowance for inflation. Under a PhD scholarship plan announced (Edmonton Journal, October 22, 2003, Page B1) by the University of Alberta the University will award 160 scholarships of \$21,500. No teaching assistant duties are involved

also in freshman chemistry. He treated students harshly - no nonsense. After that until the end of 1942 I was a T.A. in analytical chemistry - just right. The analytical chemistry laboratory had about 100 or so students and there were three or four teaching assistants. The positive reactions of students to the help I gave them encouraged my interest in teaching. My experience as a T.A. in the analytical chemistry laboratory along with my research activities led me to wish to pursue an academic career.

### Uranium and Thesis Research

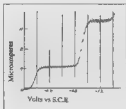
Uranium was an obscure element of no great interest when I started my research in 1939. Uranium ores were mined almost solely because they were the source for radium. The uranium itself was mostly discarded as waste. During the next few years former graduate students or technicians would return for visits to Minneapolis from their work such as at the Chicago Metallurgical Laboratory, Monsanto in St. Louis, or Oak Ridge Tennessee. Bits and pieces of their conversations with me indicated that they had far more than a casual knowledge about uranium. Post war information showed that they were involved in the secret Manhattan Project. From the various bits of information I gained I soon realized that something really big was going on with uranium. One technician told me that significant amounts of uranium-235 had been separated. I kept my mouth shut except to Phyllis. I worried about Hitler or Japan and wondered at what stage Germany or Japan might be with respect to an atomic bomb. Post war information indicated that in the event Hitler had done little but Japan was more advanced.

During the first 2.5 years in graduate school, that is until the end of 1942, I completed the required course work in analytical and physical chemistry, attended the seminars, completed the foreign language requirements, became a certified instructor in gas and bomb defense, and passed the preliminary Ph.D. examinations. I had assembled a manual polarograph and had obtained polarograms of dilute uranyl chloride solutions.

There were difficulties with manual polarographic measurements mainly arising from the fact that pentavalent uranium is unstable and that the current is never steady but goes from zero to a

maximum every three or four seconds. Progress was slow in gaining understanding.

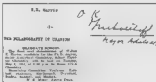
At the end of 1942 Dr Kolthot had asked me to interrupt my thesis research and to help start the war research project on synthetic rubber. He promised that in the summer of 1943 I could take six weeks to complete enough experimental work on uranium polarography for my thesis. That was a frantic six weeks. I strung a pair of wires from my lab to the other side of the building to a dark room with a recording polarograph. With the recording polarograph I could obtain the kind of detail that I could not with the manual apparatus and greater understanding then became possible. The following diagram is an example of a polarogram under favorable conditions. The first part from about -0.2 to -0.8 Volts indicates the reduction of hexavalent uranium to the unstable pentavalent state and the second part at higher voltage represents the reduction to the trivalent state.



A well defined polarogram of microcurium chloride in 3-4 millimolar HCl (From my PhD thesis)

After the six weeks of additional, thesis experimental work in mid 1943 I had enough data to complete my thesis. During odd times over the next months I wrote up a thesis and obtained the PhD in June 1944.

My thesis was deposited in the Graduate School of the University of Minnesota. With Kolthot I wrote three articles from the thesis for publication in the Journal of the American Chemical Society (57, 1484-90, 1945; 68, 1175-79, 1946; 69, 446-51, 1947). I began to get periodic visits from the FBI with



Thesis clearance note from Kolthot and announcement of the PhD oral

requests on behalf of some company (for example Du Pont) or country (for example Brazil) requesting permission to make a copy of my thesis. The Minnesota regulations were that the author had to give such permissions. Much later in the summer of 1956 I spent a summer carrying out a research project at the Chalk River Laboratory. One day when I was there Dr. Les Cook took me to the formerly secret document room in their library. He showed me a secret document - a copy of my thesis - that they had obtained during the war under the cloak of secrecy because uranium was involved.

### **War Research - Synthetic Rubber**

For my work on the synthetic rubber research project Kolthof applied to Washington for military draft deferments every six months. In June 1945 I was briefly in the U.S. Army until another deferment came through.

In 1942 the natural rubber plantations of the far east were in enemy hands and the U.S. had only a 1-year supply of rubber. Rubber could not be spared for civilian purposes. Means for manufacturing synthetic rubber was therefore a matter of extreme importance. The Minnesota group under Dr. Kolthof was one of about a dozen to carry out research on the urgent problem. Our group studied the emulsion copolymerization of butadiene and styrene at 50° C. The usual recipe was: butadiene - 75, styrene - 25, Ivory soap - 5, potassium persulfate - 0.3, high molecular weight mercaptan - 0.3, water - 180.

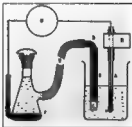
Kolthof assigned me to the problem of studying the role of a variety of mercaptans in the polymerization process. As a research topic my problem was one of the best and most rewarding of those in the rubber project, a plum assignment. Mercaptans of high molecular weight are sometimes perfumes while those of low molecular weight smell foul. The skunk uses one of them. My friendly colleagues began to call me "the inside man at the skunk works"

The first research focus was to develop a fast and accurate method for the determination of tiny amounts of mercaptans. Within a few months I had developed a method for the amperometric titration of small amounts of mercaptans with silver nitrate and with a rotating platinum indicator electrode.





The apparatus for amperometric titrations of mercaptans is shown in the figure. It consists of a rotating platinum electrode (A), a sintered glass tube (B), an electrolyte solution (C), a salt bridge (D, E), a reference electrode -0.23V vs S.C.E. (F), a microammeter (G), and an electric motor (H).



Apparatus for amperometric titrations of mercaptans (from *Analytical Chemistry* 18:141 (1946))

The next problem was to apply the analytical procedure to measure the amount of mercaptan remaining at various stages of the copolymerization process - that is in the presence of rubber. We were anxious to be able to carry the studies forward but were stymied by the coagulated rubber gunk. There was also a challenging sampling problem to handle involving the water-organic system. Kolthoff kept on top of progress and would leave his notes with suggestions for work. Once, he went off to a meeting for a week and left me with a list of things to work on. On his return he came to my laboratory and began to quiz me. He asked did I try this? No. Now, with some impatience, did I try that? No. With real annoyance, how about this idea? No. Then I managed to get his attention "let me show you this". I had solved the rubber crumb problem by making the platinum electrode rotate backward though the material to be titrated. It was my mechanical and practical farm boy solution to the problem instead of a purely chemical approach. From then on when he had visitors he brought them to show off the analytical process.

Every six months members of the various universities and industrial organizations carrying out synthetic rubber research met to interchange information. The meetings alternated between New York City and Akron Ohio. In that connection I was scheduled to give my first oral scientific presentation. I also had my first ride in an airplane from Minneapolis to New York on a DC-3. While flying smoothly over

Lake Michigan we had a nice pork chop dinner but near New York the ride was rough and I lost it just while landing.

I continued synthetic rubber research to the end of the war with both Germany and Japan and until the summer of 1946.

#### End of the War, Lectures, and Future Plans

In the fall of 1945 I began to look to the future and began to consider a possible academic career. Since I would need to give lectures probably with any future job, I decided that I should obtain competent instruction about oral presentations from an expert source. I enrolled in a night school course called Speech taught by Prof. E.W. Ziebarth of Continuing Education at the University of Minnesota. For me the idolization of those who use "no notes" was put in perspective. In his course Ziebarth made it clear that to give lectures or talks without notes has no special merit. With or without notes is simply a matter of personal preference. Some of the most engrossing spellbinding lectures and also some of the most abominable ones I have heard are "without notes." He told us "Don't be obsessed with form over substance." The important thing is to make effective presentations. Ziebarth gave me confidence to try to do things according to what would be effective for me. His advice was too late to help me as a student, but for my future, it was invaluable. Ziebarth is now deceased.

Kolthof was a genius with respect to matters of research. However, he believed in some special merits of "without notes" for lectures and talks. For him I don't think it was an egotistical matter, but simply an unshakable belief that it was applicable to everyone. Kolthof would too easily make up his mind about graduate students and what they should or should not do in the future. A couple of decades after I had graduated, Kolthof's former secretary (M. Miller) told me in confidence that Kolthof wrote letters to potential employers indicating that I would be unsuited to a university career. His conclusion probably stemmed solely from his observations of my oral unease in the graduate student seminars and their required and unreasonable unprompted stump speeches.<sup>41</sup>

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<sup>41</sup> For several years after I had come to the University of Alberta he continued to inform me about industrial openings. I think he remained convinced that academia was not for me.

Years later, in November 1973, the University of Minnesota honored me with their Outstanding Achievement Award. The Chemistry Department asked me upon my to return to Minneapolis to give a talk. I talked about Programmed Temperature Gas Chromatography and know I presented a good lecture on the subject that I had long studied. Kolthof sat in the front row and after the talk I came to sit beside him. He looked confused and had to ask "Were you using notes?" Of course I had but he didn't know for sure! On the matter of form he had remained unchanged.

### **Jobs**

In 1946 in contrast to the employment situation in the 30's, there were now many jobs. Shell Development Co. in Emeryville California wanted to offer employment. Assistant Chemist for Duty with the Panama Canal was another offer. Clinton Engineering (Manhattan Project) at Oak Ridge wanted to hire me. P J W Debye, the Head of Cornell chemistry and a friend of Kolthof, had put out some feelers. Some years later D.D. Phillips of Cornell told me that Cornell continuously had an opening for a Kolthof graduate. In Canada, Polymer Corporation in Sarnia wanted to employ me for a then handsome salary because I had been working at the U. of Minnesota on synthetic rubber during the war.

Nevertheless, I wished to enter a university career and to return to Canada. The University of Manitoba offered me a position for \$1800 - which I understood was the normal annual salary to be expected. Dr Walker came to Minneapolis to interview me and to recruit me to return to the U. of A. At one point he wrote me a letter asking me not to accept other employment and to give him a few days to get authorization for a position. I do not recall that there was negotiation but my salary<sup>42</sup> was to be \$3000. Available housing in Edmonton was nonexistent in 1946. As encouragement Walker told me that housing was being built for new staff. When we came to Edmonton the housing had not been completed. During the year we moved 12 times to various accommodations including the home of my parents 8 miles east of Wetaskiwin during

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<sup>42</sup> In 1980 my last year salary before emeritus was \$47 213.

emergency periods. The University housing (called "Rabbit Row") was completed about a year later near where the Education building (#89 and #105 on the Campus map) is now located. We moved to that housing on September 1, 1949 (rent \$50/month) in the summer of 1947 and stayed there for the next four years.

## B - LEAVE OF ABSENCE 1957-8

By the 1956-7 session I had been on staff for a decade and had given instruction to about 5000 students in various classes. I needed a change. I now had permission to seek a year leave of absence for the year 1957-8. In the fall of 1957 the Department would have a new Head. I was filled with optimism about the future of the Chemistry Department and looked forward to a role in it. I did not anticipate that analytical chemistry would soon receive a hostile reception (Section 3.5). When Dr. Gunning was interviewed for the job of Head and when I went to Miami to see him (Section 3.1) on behalf of the Selection Committee he gave no hint that he would do anything other than build.

There were signals of rocks on the road ahead that I overlooked with my optimism. On March 16/57 I received a long letter<sup>43</sup> from Dr. R. McIntosh. He was one of the three that had been interviewed (Section 3.1). He was more perceptive about the future of Analytical Chemistry at the University of Alberta than I was. He wrote that if we hire Gunning the "fur will fly". He mainly wrote to suggest that I should consider going to the new University of Waterloo and gave me the name of one I should contact. Another signal came when, late in the year, I received information from Edmonton that Gunning intended to make curriculum changes that would marginalize analytical chemistry. I am grateful for his ensuing procrastination.

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<sup>43</sup> Deposited in University Archives "Appointment of a Head for Chemistry, 1957"

### The 1956 Year

To obtain a leave I had to find a replacement to teach my courses. My colleague Dr W. Allen at the then Calgary Branch was willing to come to Edmonton for the year provided that I would get someone to come to Calgary to take his load. By good fortune Dr. B. Dunford at Dalhousie was willing to substitute for my substitute and only then did I have final permission to confirm the leave of absence. Arrangements were made for the leave of absence to be at Chalk River National Laboratory near Deep River, Ontario. Dr John Hardy from the Chemistry Division at Chalk River was to go on leave and arrangements were made to rent his house in Deep River. Responsibilities on the appointment committee for the new Head of chemistry continued to need my attention.

At last preparations for the long desired leave of absence were complete. We planned to leave at the end of June after the school year was over for our children, Margaret and Bill. Our house was to be taken over by Willard and Audrey Allen for the year starting on July 1. In mid June, I left for the CIC meeting in Vancouver and Bill kissed me good-bye. Almost immediately after that he came down with mumps. About July 1 Margaret became sick with mumps and a day later I came down with a really bad case. A couple of weeks later I had recovered enough and the Allens could make the delayed move into our house.

### Deep River

As soon as I was able to travel we drove to Deep River by way of Saskatchewan, North Dakota, and northern Michigan. We arrived and settled in to our house in Deep River. A daily bus service took employees the 12 miles to work at the Chalk River site. During the day I had totally uninterrupted time to carry on research. The phone didn't ring, no committee responsibilities, and no meetings.

I had made tentative plans to carry out research on activation analysis with Dr. R. Jervis. Dr. Betts had earlier written to me about another possibility and that was to work with Dr. W. McFadden on hot atom chemistry. That became the fortuitous choice. It led to the beginning of my work on gas chromatography. Hot atom chemistry was also a new field of study that, luckily for me, had been devoid of the

attention of any analytical chemist. There were beautiful projects to be harvested by the analytical approach that were a delight to me. The field of gas chromatography was just opening up and it gave me entrance to that field at just the right time. We planned well and worked effectively.

### Family

Every evening after work and weekends were open for family projects and enjoyment. We joined the Car Club, the Photography Club, the Bridge Club, and the Yacht Club. One weekend we went to Toronto and bought our first ever new car - a brand new 1957 Pontiac. We toured the countryside. We saw Niagara Falls. During Easter we drove to Washington and visited the Marvins (Bob Marvin had been my best man at our wedding) and the McDougals (Margaret McDougal had been the bridesmaid.) At the National Bureau of Standards I met John Taylor who became a long term friend and colleague.

As a family we had a great year. Sputnik I was put up by the Russians and one evening in the field behind our house we saw it pass over. About that time there began to be talk of putting a man on the Moon. I recall telling McFadden that engineers would never accomplish that because it was too risky. We did many new things and we traveled a whole lot. I think Margaret had an easy year in school and made many friends. Bill came innocently into his grade and obtained the top grades in his class. Another boy who had been used to being at the top caused Bill distress - jealousy.

### Confidence

One of my most valuable acquisitions during the year was gaining a sense of self confidence. I had been giving lectures to students during the previous decade without really knowing about my competence or lack of it as a lecturer. I particularly liked lecturing to the freshman chemistry students and giving invited lectures to Dr Walker's students in analytical chemistry. Less favorable were the lectures to unresponsive third year engineering students where rather little came back from the other side of the bench. At Chaik River colleagues in the Chemistry Division wanted to know more about the new field of gas chromatography and I agreed to give a talk on the subject. After the talk

I received innumerable compliments. That surprised me and gave me a real boost. In the spring I attended the annual meeting of the Pittsburgh Conference on Analytical Chemistry (when it was still held in Pittsburgh). I gave a second talk after I returned from the Pittsburgh Conference again with morale-boosting compliments. I was able to return to the U. of A. with self confidence about an ability to lecture. Another aspect - for a decade with few resources and certainly heavy teaching responsibilities I had carried out but little research. I wondered whether I could be effective in that respect. During that year on leave I was the principal author of six refereed publications. Thus, a fine result of the year was that I gained confidence that I could return to Alberta and contribute to both teaching and research.

### Return

I am not certain of the sequence of events but during the year Dr Harry Habgood of the Alberta Research Council and I realized that we were both entering the field of gas chromatography. We corresponded and agreed that on my return to Alberta we would collaborate on research in the area

On our return journey I recall that we had driven the first thousand miles or so through cloudy dull rainy weather. When we hit Minot N.D. there was the beautiful blue western sky. Our spirits were high but they were given a further boost. In my mind I was returning to Alberta where I would be part of a new vital department. I would inherit the introductory course in analytical chemistry (Chemistry 58) I would also continue to teach senior analytical courses. I would begin joint research with Habgood in gas chromatography. I would collaborate on an electrochemical research project with Wallace. And I expected to have the assistance of graduate students for research and teaching assistants to help in laboratory instruction. I felt totally optimistic about my future in a Department in transition from essentially only teaching to one of both research and teaching. I anticipated no clouds that were on the horizon (Section 3.5).

## C - RESEARCH AND TEACHING

This Section describes my experience with respect to the two rewarding activities of teaching and research. There are two distinctly different periods. During the first decade the University was a teaching institution with heavy teaching responsibilities and but little support for research. In the second and longer period excellent conditions were in place for both teaching and research.

### C.1 RESEARCH

#### The First Decade, 1946-57

During my first decade on staff undergraduate teaching was almost the sole responsibility and there was scant time and few resources for research. Initially I made the mistake of thinking I could continue work on synthetic rubber. At the University of Minnesota I had been part of a group with technicians and an extensive backup organization. A polymer research group was being formed in Canada including C. Winkler of McGill and L. Cragg of McMaster. Since I had worked on synthetic rubber for some years I was invited to be part of the group. It was an error on my part to have accepted the invitation. I spent one summer at Polymer Corporation in Sarnia and completed a project involving acrylonitrile-butadiene copolymer. The manuscript from the work, similar to some of my earlier publications, was submitted to Leo Marion the Editor of the Canadian Journal of Chemistry. He rejected it out of hand possibly because it was not well presented and probably because it was analytical chemistry. That was the end of my polymer research career. I probably should have submitted the manuscript to the Journal of Polymer Science.

I had one rewarding summer at AECL in Chalk River with Dr. R. Betts on the isotopic separation of sodium-22 and sodium-24. Another project involved joint work with Dr. B. Riedel of the Pharmacy Department and another was with Dr. G. Govier of the Chemical Engineering Department. I most wanted to get into the field of activation analysis but the facilities were not available in the Department. At the end of the decade, the year 1957-8 was a marvelous one when I had the leave of absence at Chalk River (Appendix B).



### The Later Years - 1958 and beyond

Upon my return from the leave of absence I had many things to do. I was in the midst of processing the raw data I had gathered on hot atom chemistry and completing manuscripts. I had inherited the beginning course in analytical chemistry and wanted to begin its revision and to get it started on a sound footing. I wanted to get started on my research collaboration with Dr. Habgood. I had to present a research seminar to the department. The seminar was an immediate challenge and an opportunity. I could have talked about gas chromatography more easily but chose to talk about the chemical effects of nuclear transformations in alkyl bromides - work which was vastly different from usual chemistry.

In 1958 the conditions for carrying out research were excellent. There was little interference from outside distractions. However, at that time virtually no graduate students chose analytical chemistry - it was a field seemingly in demise. In the late 50's I therefore had no assistance from graduate students to help with research. I personally carried out experimental work in collaboration with colleagues.

As indicated in Appendix B in 1957 I had corresponded with Habgood, a physical chemist, at the Alberta Research Council (ARC) who like me had just entered the burgeoning new field of gas chromatography. Gas chromatography was taking the scientific world by storm - not only in chemistry, but biochemistry, food science, petroleum, chemical engineering, dairy science, and so on. We completed the first theoretical research on programmed temperature gas chromatography. In Habgood's laboratory we obtained the fundamental experimental results needed for the theoretical interpretation. With the financial support of ARC, we organized and made most of the presentations at the Second Alberta Symposium on Gas Chromatography on February 18, 1959. In a short time (1962) we received an invitation from Wiley publishers to write the book on the subject<sup>44</sup>. We had a great decade of work together.

For me it is especially interesting to know that groups at the University of Saskatchewan and the Saskatchewan Research Council

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<sup>44</sup> *Programmed Temperature Gas Chromatography* was published in 1966, John Wiley and Sons, New York.

used programmed temperature gas chromatography as one of the means by which they genetically modified rape to produce what is now called canola. This GM crop is cultivated world wide. The fields of yellow that I see every summer give me a good feeling. In Canada, about three million acres of canola are planted each year and over a million tons of canola oil is obtained.



Beautiful yellow fields of canola in July

Another collaboration was with Dr. W. Wallace (inorganic). Our joint research problem required the use of the technique of polarography where I had experience and I was pleased to be able to collaborate with him. In the work with Wallace we had the use of a commercial polarograph (Electrochemograph). Our main studies were polarographic studies of the hydrolysis of halopentammine-chromium(III) ions.

In more recent years studies of risks associated with low dose exposures has been a topic of interest for me. Collaboration has also been rewarding with Dr. Kratochvil on several topics such as sampling, analytical chemistry instruction, gravimetric titrations, and writing textbooks.

I had graduate student collaboration for about one decade during the mid 1960's and up to 1974. We collaborated mostly on gas chromatographic topics. I had a total of 7 PhD graduate students, G.D. Lutwick, J. H. Breckenridge, D. L. Ball, J. R. Dean, R.R. Goforth, P. C. Kelly, and G.W. Scheil and 8 MSc students, M. Hironaka, W.N. McKay, J. F. Fryer, J.E. Evanoff, J. M. Gray, D. de



Research group February 1971. L to R: Danilo de Oliveira (Brazil), Trevor Higgins (England), George Scheil (U.S.), W. Harris, Dr. Boris Rudenko (Russia).

Research group February 1971. L to R: Danilo de Oliveira (Brazil), Trevor Higgins (England), George Scheil (U.S.), W. Harris, Dr. Boris Rudenko (Russia).

Oliveria, I. N. Higgins, and E.A. Frommer. The maximum number of graduate students I had at any one time was four.

I submitted some of my manuscripts to the Canadian Journal of Chemistry. I chose to publish most of my work in international journals in my field. Analytical Chemistry, Journal of the American Chemical Society, Talanta, and Journal of Physical Chemistry. I attended a conference in Canada once per year and annually also I attended a meeting of the American Chemical Society (ACS). At these meetings, my colleagues and I presented the results of our studies. Presentations have been made at various universities and in Czechoslovakia, Germany and Denmark. In 1961 a major presentation in New York City at an ACS meeting on our gas chromatography work was rewarding.

With one exception, for the authorship of books I worked with co-authors and had assistance from colleagues. For the second edition of Chemical Analysis those who assisted are shown in the photo.

My research publications record over the period 1946 to 1995 is summarized as follows.



Colleagues in the preparation of Chemical Analysis Second Edition. Left to right: B. Krasnodar, (reviewer), J. Plazbeck (reviewer), D. Rabenstein (reviewer), P. Harris (editor), L. Zosa (typist), B. Burrows (library searching), G. Horlick (reviewer), G. Johanson (draftsman). W. Harris (author kneeling).

#### Research and Scholarship record, 1946 to 1995

##### Scientific Books

*Programmed Temperature Gas Chromatography* John Wiley New York, 1966, 305 p with H.W. Habgood. Russian Translation 1968, by Dr Rudenko, cost of the translated book, 2 rubles.

*Chemical Separations and Measurements*, W. B. Saunders, Philadelphia, 1974, 284 p with B. Kratochvil. First edition, Barnes and Noble, New York, 1969,

*Chemical Analysis*, Second Edition, McGraw Hill New York, 1975 611 p With H.A. Laitinen, Russian (5 rubles), Spanish, and Chinese translations, Paperback International Edition. Also Persian translation authorized but I do not have a copy

*An Introduction to Chemical Analysis*, W.B. Saunders, Philadelphia, 1981 611 p With B. Kratochvil. Paperback International Edition.

*Instructors Manual* to accompany *An Introduction to Chemical Analysis*, Saunders, Philadelphia, 1981 87 p With B. Kratochvil. First edition, 1974.

*Risk Assessment*, Wuerz Publishing Ltd, Winnipeg, 1997, 124 p Wuerz is now bankrupt.

#### Table 1

Time period	# Papers	Comment
1946 - 50	8	U Minnesota research
1951 - 55	0	Teach about 500 students/year
1956 - 60	11	Research/teaching
1961 - 65	13	"
1966 - 70	18	"
1971 - 75	17	"
1976 - 80	13	Chairman of the Department
1981 - 85	3	Emeritus
1986 - 90	5	Emeritus
1991 - 95	7	Emeritus

## C.2 TEACHING

### The First Decade, 1946-57

During the first decade my normal teaching load was a set of lectures for a section of freshman chemistry, instructor in the introductory analytical chemistry laboratory, analytical chemistry lectures and laboratory for engineering students, instrumental methods of analysis, advanced analytical chemistry, and general supervision of the freshmen chemistry laboratories with Dr. Davis. Each year I had about 500 students in various classes.

In my first year as an academic staff member I worked on the development of a course in instrumental methods of analysis. It was the first such course in Canada and probably only a couple of universities in the U.S. had such a course at the time. Four years later the first version of a textbook on the subject was published by Willard, Merrit and Dean.

I worked closely with Walker in that he asked me to instruct the laboratory for his course in analytical chemistry. There were no T.A.s, and only a couple of student demonstrators to give some assistance. In my first year the laboratory instructional duties in the analytical course took a lot of time. As a new instructor I found Walker to be an always helpful colleague, and to give good advice when asked.

#### **The Later Years 1958 - 1974**

The analytical chemistry courses were the introductory one, normally for second or third year students, and the senior ones, instrumental methods, electroanalytical, and advanced analytical. Beginning in 1958 I taught only analytical courses and a little later only the introductory course. Since the introductory course had by far the most students, it warranted most of the limited time I could devote to teaching. An objective of the instruction of the introductory course was to assist students on their way to becoming competent, confident, effective experimentalists. When I began to teach that course in 1958 it needed to be modernized. Modernization meant the introduction and adaptation of new topics and experiments.

At a time when increased enrollments were desired, enrollment in the introductory analytical course increased rapidly. In 1958 there were 30 students in the class. Seven years later there were 200 students.

In the lectures and laboratory I wanted to provide conditions where high quality work would be desired and could be carried out. Valid samples are usually a problem - that problem had to be and was solved. Workable instructions for the experiments had to be ensured. Students were given a body of work for the laboratory. They then formulated and carried out their own plans - not the details of an instructor's plan. Over the years increasingly rigorous grading scales could be developed and optimized. Since the highest quality experimental work is done both carefully and quickly, students were

given a bonus for high quality results completed without undue delay. It is a reality that fraud is known in and out of universities. An instructor needs to recognize that students are not immune<sup>45</sup> and may be tempted to employ questionable tactics.

A 90-page instructors manual<sup>46</sup> was developed. The topics covered are: teaching analytical chemistry, the introductory laboratory, first meeting of instructors, preliminary operations, practical test, comments on experiments; samples, grading; the defective analysis, analytical instruction, objectives, techniques, and evaluation, historical perspective; answers to problems.

### Teaching Assistants

In 1958 teaching assistants became available to help with laboratory instruction. I required TAs to do only minimal grading of reports. I expected them to be committed to the success of the students in their sections. After a few years, I realized that TAs should have formal instruction. I established a weekly one-hour meeting with teaching assistants for instruction, motivation and for interchange of information about the current operations. New teaching assistants were

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<sup>45</sup> When O.J. Walker taught the introductory analytical chemistry course, cheating was certainly not a special problem. However, he included one easy, interesting experiment for which the value of the correct analysis is well known. The instructions were clear and straightforward. Students who were so inclined could "cook" the report of their analysis. If they did so then in their submission of the dozen or so presumably experimental numbers they would inadvertently report a crucial intermediate "observation" that is impossible and unequivocal evidence of fraud. The important fact arising from the Walker "integrity" experiment was that if students think their cheating will not be detected then more than half do cheat. His course had a cross section of students - medical, engineering, agriculture, science and a smattering from arts, but none from accounting or law. Obviously he could have but did not report hundreds for plagiarism/cheating. I don't know why Walker gathered the information and how he used it. I suspect he wanted the information so that in letters of recommendation he could comment about integrity.

<sup>46</sup> *Instructors Manual, An Introduction to Chemical Analysis*, Harris and Kratochvil, 1981 Saunders College Publishing, Philadelphia.

tested for their competence with respect to basic operations. If a student failed an experiment, the teaching assistant and the student jointly reviewed possible causes of failure and submitted a report on a small card. As an extra benefit, it was hoped that both would be motivated positively.

The Laboratory Coordinator, Dorothy Cox, was enormously helpful in bringing about the operation of a smooth running lab. In the early years most of my teaching assistants were not doing graduate studies in analytical chemistry. The teaching assistants for the course did an outstanding job in giving students their best advice. I mention a couple. Lorne Hollingshead, an organic graduate student, was a quiet capable person who gave his students sound expert advice. I chanced upon him one Sunday morning spending extra time working out the details of an experiment that was causing trouble, so that he could better advise the students in his section. Later he gave up his graduate studies and became a prize-winning instructor at SAIT. Lou Neering (Inorganic) was another. He was an outgoing person also with a high commitment to the success of the students in his section. Near the end of the year I saw the students in his section give him a gift. He became an instructor at Malaspina College in B.C. As a hobby, he "analyzed" the performances of 2-year old racehorses. At the other extreme, there were a couple of TAs whose competence or commitment was marginal. They were shifted to become TAs for other courses.

#### Course Evaluation - Discrimination

Systematic evaluations were used as a guide for improvement of instructional effectiveness. The aim was to assign superior grades for superior work and mediocre grades for mediocre work. A useful index for ascertaining instructional effectiveness is the *discrimination*. For the introductory course at the end of each academic year (it cannot be done earlier) the discrimination<sup>47</sup>  $D_{ij}$  values in percent were calculated by the following equation for each of the various items that make up the course:

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<sup>47</sup> W. E. Harris, *Anal. Chem.* **47** 1046 A - 1052A (1975).

A high school teacher brought the concept of discrimination to my attention. It is well known in the field of education. The discrimination  $D_{ij}$  is a value proportional to the difference in average

$$D_{27} = 100(*\text{top } 27\% - *\text{bottom } 27\%) / 2(*\text{maximum } 27\%)$$

The discrimination values identify those instructional items that are in agreement with the aim of good instruction and bring to light those that are weak or defective and need special attention. When discrimination is low, grades assigned for good work are lower than they should be and for poor work the grades are higher than they should be. An item with discrimination less than 10% is defective because it may be obscure, ambiguous, vague, too hard, too easy, or the result of some other instructional deficiency. If the average of the discrimination values for all the items is only about 10%, unless the grades assigned are far out of line on the high side, expect low morale and many complaints. At 20% an item may be considered adequate. If the average of all the items making up the course grade is about 20% then the course is generally satisfactory. At 30% satisfaction will be at a high level for students and staff. It is probably not possible to attain average discrimination values much higher than about 30%.

In contrast to the average grade where an instructor can move the class average up or down at will, every increase in discrimination has to be fully earned by the instructor. There are no easy shortcuts other than through superior instruction. To improve instructional effectiveness which is reflected in better discrimination:

- Give timely, organized, comprehensible lectures and instructions
- Clearly describe the chemical and other relevant background
- Instruct T.A.s. Expect commitment to the success of their students
- Maintain a good level of challenge, not out of line, easy or hard
- Maintain pleasant conditions under which good work can be done.
- Develop fair, even handed grading systems for laboratory exercises

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grades of the best 27% of the class and the poorest 27%. To calculate  $D_{27}$  select the top and bottom 27% of the class using a base that is as broad as possible. A convenient basis is the overall course grade for each student. For each item to be rated determine the sum of all marks obtained for an item by the top 27% and a similar sum for the bottom 27%. The maximum 27% is the maximum total obtainable by 27% of the class.



- Safeguard integrity and clobber dishonesty
- Encourage students to plan well
- Be available to give advice, provide opportunities for 1 on 1 discourse
- Systematically evaluate the course and respond to the findings

My comments about teaching introductory analytical chemistry are described in the preceding four pages. For the course, at the end of each academic year D27 values were calculated for each course item. It was not difficult to obtain acceptable levels of discrimination for items such as weekly quizzes, term tests, and final examinations. However, for laboratory work it was a different kettle of fish. At the end of my first year (1969) of teaching the course the D27 for the laboratory as a whole was only 11%. That was not a fair ball situation for the students. As the instructor I had a responsibility to try to remedy the unfairness. Many of the 20 or so individual laboratory items had poor discrimination. Discrimination information is particularly helpful in identifying items that need urgent fixing up. The payoff for students is best if the extra instructional effort is spent on the weakest links.

Over the next few years many things big and small were done to improve instruction. For my first 12 years the D27, in percent, for the overall laboratory was 11, 13, 10, 24, 25, 18, 22, 25, 30, 32, 30, 32. By the 4th year the indications were that satisfying improvement was underway. By the 9th year (1967) virtually every improvement in the instruction and operation of the laboratory that seems possible had been obtained. My impression was that everything was now humming along smoothly and that student morale was high. What was the opinion of an unbiased source? By an accident of perfect timing for me such an opinion became available in 1968.

#### **Students' Union Course Guide**

In 1968 the Students' Union embarked on a huge project of gathering confidential student opinion about courses across the University and published the 1968 Students' Union Course Guide for the benefit of future students. The laboratory and other parts of courses were

ranked by students on a 5-point scale "Poor, adequate, good, very good, outstanding" The student opinions of analytical chemistry and other science laboratories are compared in the table below. I was surprised and pleased to learn that about two-thirds of the students gave analytical chemistry a rating of "outstanding" and no student rated it as "poor". It was welcome reinforcement of the goals toward which I had been working. Recently two former long ago students<sup>43</sup> now in medical careers wrote me a remniscent letter telling me that "it was the most challenging, enjoyable and useful of all our undergraduate science courses. The breadth, depth and rigor of the laboratory were particularly notable".

Student Ratings of Laboratories, 1968

Ranking	Analytical	Other Science Labs
Poor	0%	About 25%
Adequate	0%	About 25%
Good	5%	About 90%
Very good	30%	About 15%
Outstanding	65%	About 5%

### C3 PACCR

In 1980 when I was about to retire President Horowitz asked me be Chairman of a new committee, the President's Advisory Committee on Campus Reviews (PACCR). For most of the time the steering committee for PACCR consisted of three senior academic members and the Head of Technical Services.



The PACCR steering committee: WLLH Chairman, H. Kiesel, F. Ennis and W. Jopling

Over a period of about 12 years a total of

<sup>43</sup> Dr M. Gray and Dr J. Gray in response to "Chain Reaction" a news item about analytical chemists in the New Trail, Winter 1996, page 36

127 units academic and non-academic were reviewed. The first stage in the review process was the preparation of a Self Study by the Department (See Section 4.8 – *Crawford* – for an example). During the self-study phase there was supposed to be a period of intense self scrutiny. The next stage involved a Unit Review Committee normally consisting of two external experts in the field and two from within the University. Following their on-site review that committee submitted a report. The unit under review then submitted a report in response to the review committee report. Then the Head of the department met with the President to consider outcomes.

The major issues addressed during the review process were development of academic and non-academic departments, structure and administration, problem of aging equipment, communications, graduate studies, handling major changes, professional development, reduced resources, replacement of staff, resources, sessional appointments, teaching and research, workloads. The objective was to explore means for improvement of the unit reviewed and the University. The story of the PACCR activities is described in the 10th Annual PACCR Report to the University, June 1990. The PACCR review activities had a large positive impact on the University at the time and catalyzed changes in the future years. A 13-page description of the PACCR review activities is given in *Echoes in the Hall*. (University of Alberta Press, 1999, Page 161 - 174.)

# APPENDIX II – PhDs COMPLETED

## CHEMISTRY, UNIVERSITY of ALBERTA

(Compiled by R. J. Crawford)

1959

John McDowell

1960

Christine Rosenfeld

Thomas Jones  
Gerhard Scherf

1961

Gerald Lutwick  
Richard Stock

J. Ramareddyha

1962

Jim J Cope  
Earl Milton  
Chandra Ram  
Otto Strausz

Johan Greidanus  
John Poole  
Martin Sheratte  
Mohan Vadekar

Arthur E Knight  
Jamal Quadir  
Harwant Singh  
Jeffrey Wan

1963

Samuel Braverman  
Derek Law  
Edward Piers

Garth Iverach  
Brian Leggetter  
William Rebel

William Laudlaw  
Wallace Pasika  
Jean Rousseau

1964

Michael Bellas  
Alan Hogg  
Robert Mennelstein  
Edward Robertson

David Dugle  
Roy J Kozak  
Richard Morgan  
Frank Robinson

Bert Fraser-Reid  
Robin McLaren  
Rintje Raap  
Brian Wakeford

1965

James Campbell  
George de Mare  
Anupama Mishra  
Robert Weir

George Cooke  
Thomas Dingle  
Kit Ming Ng  
Charles Woo

Robert Cushley  
Charles McDonald  
Kuljit Sidhu  
George Woodall

1966

Anthony Bosch  
Elizabeth Lown  
Marshall Nay

John Breckenridge  
Hodge MacEwen  
Ross Norstrom

S. Valverde-Lopez  
T. L. Nagabhushan  
Ian O'Neill

Hendrick Persad

Kenneth Piers

## 1967

Lorne Ball  
Edward Dedio  
John Fletcher  
Richard Messmer  
Guy Tourigny

Douglas Cameron  
Uriel Diner  
Kenneth Foster  
Ralph Moore  
Leonard Walker

Jon Collins  
Syamalaro Evarit  
Ronald Goforth  
Dianne Stover

Gurdip Singh Bajwa  
William Bowman  
John Dean  
Allan Earl  
Bruce Graham  
Michael Hogben  
Dalson Nkurika  
Mitree Ponpipom  
Stuart Searles  
Frederick Sweet

Michael Baldwin  
David Brazier  
P. Deshpande  
William Ellis  
Robert Green  
John Jenkins  
David Patmore  
Uwe Schulz  
Paul Simons

Krishan Bansal  
Noel Burns  
Dirk Detert  
Johan van de Sande  
Benjamin Harrison  
Gilbert Lanthuer  
Stephen Penzes  
Robert Schutte  
Clifford Soper

## 1969

Basil Al-Sader  
Neil S Angerman  
Peter Cradwick  
Thomas Gillan  
Kamal Jha  
Robert Long  
Howard L Yeager

Brian Alienkirk  
Mohammed Arshadi  
David Darden  
Louis Green  
Cyril Levine  
Read Seidner

Udo Anders  
Laurie Charlton  
Willem Enterman  
Joseph Grover  
Peter Cecil Loewen  
Brendan Woods

## 1970

Margaret-Ann Armour  
George Dallas  
Robert Earl  
Walter Jetz  
Cedric Mumford  
Soad Osman  
David Roark

Roger Ball  
Harry Davis  
Roger Gay  
Anna Jordan  
Wilfrid O'Callaghan  
Anita Po  
Raymond Segal

Richard Berkley  
Ismet Dzidic  
Brian Hasinoff  
Patrick Kelly  
Andrew Oliver  
Peter Quirk

## 1971

Kwasi Aidoo  
George Blakney  
Donald Francis

Robert Balahura  
John Brewer  
Klaus Hendriks

Leslie Ball  
John Evans  
Ko Hojo

James Hoyano  
Andrew Pinkerton  
Alfred Roos  
Burkhard Strehlke

Wendy Hutcheon  
Thomas Pollock  
Leonard Ruznak  
Rodney Sumner

Nobukazu Okamoto  
Pimol Rienvatana  
Surinderjit Saluja  
Kunihiko Takagi

## 1972

Albert Alexander  
Nicholas Darby  
Yumiko Hoyano  
Robert Layton  
David Othen  
Robin Roman  
Peter Van Bostelen

Lois Browne  
David Day  
Gerhard Kennepohl  
Utz Liebe  
Roland Pomeroy  
Sham Sunder  
Rastko Vukov

John Campbell  
Michael Hall  
Richard Krause  
Robert Maguire  
Alan Quirt  
Hubert Taube

## 1973

Stewart Campbell  
Leon Doty  
James Humphries  
James Purdham  
Joseph Shafir  
John Smith  
Gerald Stockton  
Peter Young

Frank Cedar  
John Filby  
Gerald Miller  
Terence Sambrook  
Kathleen Simpson  
Marco Solinas  
Peter Vitins

Meredith Cotton  
Fred Fujiwara  
John Payzant  
George Scheil  
Martin Skala  
Louiselle St. Laurent  
Kenneth Wilson

## 1974

Gerald Bolton  
Robin Dawe  
Terry Eagles  
Bryan Fuhr  
Roger Jones  
Jeffrey Rowe  
Eric Wood

Jose Calzada  
Sergio de Paoli  
Michael Falk  
Eddy Isaacs  
Harry Lutzer  
Roy Smith  
Peter Wright

Martin Cowie  
Peter Donaldson  
Salvador Fernandez  
Jackie Jamerson  
Joel Martin  
Peter Tremaine

## 1975

Julius Bernhardt  
Mary Fairhurst  
Masaaki Matsushima  
Peter Singer  
Michael Webb

William Davidson  
Yves Pauron  
Tony Pace  
Minoru Suda

Dennis Dong  
Alummoottil Joshua  
Tomoki Ruo  
Everard Trip

## 1976

Gordon Bates

Asher Begleiter

Abraham Benderly

Leslie Gammie  
Thomas Sayer  
Livia Vancea

Mary Hamilton  
Joseph Tang  
Peter Wright

Stuart Lutener  
Albert Vanroodselaar  
Nondita Yap

#### 1977

Keith Betty  
Brian Ervo  
Anita Krebs  
Pavel Neudorff

Leslie Burtnick  
Margaret French  
Sing Ping Lee  
Thomas Ryan

Jean Cooley  
William Hewson  
Peter Lockwood  
Peter Sporns

#### 1978

Anita Arduini  
Michael Eze  
Roger Guevremont  
Rolf Saetra

Frances Bates  
Richard Flanagan  
Albert Masino  
F. Souto-Bachiller

Dee Brooks  
Steven Fung  
John Rankin  
Wo Kai Yuen

#### 1979

Simon Barton  
Robert Hall  
Hussam Mohammed  
Johannes Reuvers

Wing Hong Chan  
Yan Kai Lau  
Jan Oudenes  
Alex Tindimubona

Norman Gee  
Larry W McLaughlin  
Su Ho Poon  
Dale Ward

#### 1980

Ismail Al-Daher  
Stephen Dwight  
Joan Huguet  
Monica Pakic

Eric Browne  
Mbanefo Ekwendu  
Ah Dong Leu  
Joseph Parker

Moon Ho Chang  
Ole Hindsgeul  
Steven Menchen  
Anthony Tse

#### 1981

Samuel Attiah-Poku  
Hak Choi  
Donald Hull  
Robert McCaskill  
Charles Russell  
Matthew Stainer  
John Wilson

Ronald Belchamber  
Neville J Curtis  
Mineo Kimura  
Isobel Ralston  
Mohammad Saeedi  
James Sweet

Michael Blades  
Bernard Francis  
Rahum Mashhadi  
R Stephen Reid  
Ranjit Singh  
Bela Verkoczy

#### 1982

Vittorio Farina  
Manet Tiptanatoranin

Michael Heinekey  
Ian van Altena

Roger Ng

## 1983

David Brown  
Martina Green  
Vilas Kale  
Elizabeth Stublely

Bwe Hin Choot  
Allen Hinman  
Bela Ruzsicska  
Ting Chi Wong

Robert Evans  
Robert Hux  
Subramaniam Sabesan

Teofilo Abularach  
Villar Figueroa  
Peter Hatfield  
Ngooi Ko  
Richard Moore  
A. Venezia-Floriano

Paul Anderson  
Michele Floriano  
Boban John  
Janet Laird  
Isaac Oppong  
Joanne Zwinkels

Pierre Beaulieu  
Barbara Gour-Salin  
Soo Khoo  
Christian Meintzer  
Bruce Sutherland

## 1985

Gaetan Angoh  
Mukund Kulkarni  
Luis I Pena-Rodriguez  
Yvon Theriault

Lynette Fossey  
Sandro Marra  
William Rendall  
Maria Villa

George Gillson  
Michael Moir  
Mohamed Shehata  
Hla Wynn

## 1986

Baltazar Aguda  
Li-Kang Ho

Etchri Amouzou  
Webe Celine  
Kadima

Sharon Bennett  
Janice Kelland

Montse Linas-Brunet  
Maria Pedras  
Laird Trimble

John MacAulay  
Jamal S Swellich  
Ravi Vinayak

Lloyd Nelson  
Khoon Tan  
Ruiming Zou

## 1987

Anthony Alexander  
Gunadya Bandarage  
David Cheshire  
Makarand Gore  
Do Hyung Lee  
Vicente Samano  
Francisco Talamas

Eugenio Alvarado  
Leslie Barta  
Swapan Chowdhury  
Paul Harrison  
Daya Muhandaram  
P. Senanayake  
Samantha Tan

Lee Arnold  
Michael Burke  
Claude Dufresne  
Mohammed Kashem  
Brahma Ramani  
Lu Set

Adejare Adeniran  
Laurie Danielson  
Angelo Fernando

Yung-Fong Cheng  
Terry Dubetz  
Chanchai Ghosh

Patrick Chow  
Vidanagamag Epa  
Jamey Hovey



Vassilios Karanassos  
Joseph Lam  
Gordon Nicol  
Milan Ralitsch  
Garry Yamashita

Kim Kasperski  
Hanju Liu  
Wilson Njue  
Shawn Ramer

Wendy Lam  
Charles Lucy  
James Nolan  
John Smith

## 1989

Romano Andrade  
Janusz Daroszewski  
Gregory King  
Keith Lepla  
Sunil Parsare  
Kwok-kueng Shiu  
Brian Vaartstra  
Virginia Wiszniewski

Taryn Boivin  
Uday a Gokhale  
Richard Krentz  
Ian MacDonald  
Steven Pitts  
Michael Stewart  
M-A. Vaughan

Wing Chan  
Gertrude Kasitu  
Charles Lai  
Ali Mohammed  
Vinod Sandhu  
Bruce Todd  
Dean Wallace

## 1990

Stephen Astley  
Xiao Huang  
Nghua Le  
Angelina Morales  
Goccol Persaud  
Shuyuan Yu

Jian J Chen  
Michael Ekonomou  
Yu-Ting Ma  
Gary Paul  
Elisabeth Verpoorte

Liangbing Gan  
Dietmar Kennepohl  
Leah n Marquez  
S. Peiris  
Yuming Xu

## 1991

David Antonelli  
Sylvain Daigneault  
John Hiebert  
Antonio Joussef  
Robert McDonald  
William Pettit  
Gerardo Ulibarri

Raymond Bergstra  
Mareu Griffith  
James Jenkins  
Patricia Lane-Bell  
Robert McLaren  
Patricia R Rose  
Guojian Xie

Sew Yeu Chew  
A. Hawavitharana  
Jyothi Joseph  
Weide Luo  
John Peak  
Yonghong Song

Naim Al-Said  
Derek Cole  
Xizhong Li  
Karen McDonald  
Fu Qin  
Qingping Wang

Andy Chan  
Yongxin Han  
Zhe Li  
T. McGowan  
Robert Reed  
Tiebang Wang

Hengmiao Cheng  
Jin Huang  
Hartford Manning  
Yunlong Pu  
Allan Torres  
Jianliang Xiao

## 1993

Laura M Chan

David Chen

Wenyi Fu

James Kapron  
Todd Lowary  
Chu Ming Yang

Jeffrey Keillor  
Daniel Raymond  
Chengzhi Zhang

Xiaohong Lau  
Liang Tang

## 1994

George Agnes  
Frank r Barnesi  
Alebachew Demoz  
Xinbang Feng  
Clifford Keefe  
Richard Nagorski  
Lei Qiao  
Heather Starke  
Keifei Wang  
Wen-Lung Yeh  
Zhang

Fred Antwi-Nsiah  
Ruzhong Chen  
Nola Etkin  
Xingguang Guo  
Zhong Li  
Davinder Nagra  
Leslie Rawluk  
Weimei Sun  
John Washington  
Xie Yu  
Jianzhong Zhang

Marica Bakovic  
Elizabeth Cruz  
Zhonghua Fan  
Weimin Jiang  
Xiang Liu  
Maarten Postema  
William A Sherwin  
Karen Waldron  
David Witter  
L. ZhangShuliang  
Jian Ying Zhao

## 1995

Michel Cantin  
Brenda Kellogg  
Sipho Mamba  
Xiao Shang  
Li-Sheng Wang  
Yibang Zhao

Kingsley Donkor  
Norman Kong  
Craig Railton  
Yimin Sun  
Philip Wickens  
Yuhui Zhao

Daniel Pigey  
Jingyi Li  
Hongji Ren  
Stan Tsai  
Xingwang Zhang

## 1996

Yoram Apelblat  
John Klassen  
Yaoquan Liu  
Stuart Schroeder  
Randy Whittall

Gregory Fulton  
Zhada Lan  
Steven Magnuson  
Kak-Shan Shua  
Yannu Zhang

Floria Rosa-Gutierrez  
Jin Li  
Tian-Fu Mao  
Ian Stewart  
Zhongsheng Zhang

## 1997

Nghia Chiem  
Michael Jeannot  
K-A. O'Callaghan  
David Schriemer

Henry J Crabtree  
Pu-Ping Lu  
Randall Purves  
Brian Sterenberg

Darcy Hager  
Michael Mikoluk  
Elaraf Ratemi  
Yuanxi Zhou

## 1998

Sue Jee Bay  
Barbara Ellis

Charles Carter  
Yong Gao

Jason Cooke  
Renata Jankowska

Rong Jiang  
Devanand Pinto  
Jeffrey Torkelson  
Judy Yip

Minhui Ma  
Paulo Sgarbi  
Karl Voss

Darrin Lee Mayhew  
Daqing Sun  
Wen Yang

## 1999

Karine Auchair  
Jianxun Chen  
Natalia Felitsyn  
Xiao He  
Astrid Jurgensen  
Okemona Oke  
Duong Tran  
Jia Zhu

David Barnett  
Yueqin Dai  
Darren George  
Clara Hernandez  
Ali Mukherjee  
Xiangrong Qiu  
Lishi Ying

Nora Chan  
Trevor Dzwiniel  
Todd Graham  
Hailong Jiao  
Mwaniki Ngori  
Frank Schweizer  
Junhu Zhang

## 2000

Hossein Ahmadzadeh  
Christopher Daley  
Michael Finot  
Suzanne Hof  
Robert Lam  
Christina Older  
Mousumi Samnigrahi  
Mark Webb  
Zheru Zhang

Said Attiya  
Stephen Decker  
Jiasheng Fu  
Ian I Ireland  
Tai Wei Ly  
Xiangping Qian  
S. Wacowich-Sgarbi  
Jason A Wiles

Don Coltart  
Michael Ferguson  
Rodney Gagne  
Manjinder S Lall  
Gregor Ocvirk  
Dawn a Richards  
Ying Wang  
Liang Z Yan

## 2001

Mohammed Badal  
Zhaoxun Chen  
Grace Greidanus  
Bernd Keller  
Allison Mills  
Robert Polakowski  
Udo Verkerk  
Can Wang  
Vince Yeh

Jennifer Caplan  
Siew Cheng  
Guifeng Jiang  
Nan Lishu Liu  
Mark Nitz  
Truong Ta  
Zheng-ping Wang  
Mentian Wang

Spencer Carter  
Megumu Fujita  
Patrick Kamau  
Chun-Sheng Liu  
Tyler Norsten  
Paul Tiege  
Jianqi Wang  
Grant Wangila

## 2002

Murwaas Aktary  
Ru Chen  
Russell Handy  
Yaqian Liu  
Ming Qi  
Rajendra Subedi  
Henry Ninghui Yu

M. Al-Sayah  
Kelly Chichak  
Shunzhen Kang  
Jeremy Melanson  
Yeeman Ramtohal  
Steven Trepanier  
Yuming Zhao

Nicole Baryla  
Alan Doucette  
Gregory Kiema  
Andrew Myles  
Dusan Rustic-Petrovic  
J Van Wyngaarden

## 2003

Hua Cheng  
Panagiotis Hatzis  
Abebaw Belay Jerner  
Darren Lewis  
Sukhdev Manku  
John Sorensen

Vasile Purdai  
Soleiman Hissaindee  
Jason Kennedy  
Lesley Liu  
Michael Pollard

Sylvie Garneau  
Xiaojun Huang  
Christopher Lee  
Quinn Major  
Kimberly Roy  
Nan Zhang





1934 FRESHMAN STUDENT  
1946 ASSISTANT PROFESSOR  
1974 DEPARTMENT CHAIRMAN  
1990 PROFESSOR EMERITUS  
1992 END PACCR REVIEWS  
2003 HISTORY COMPLETED

A39831